An Empirical Investigation of the Acceptance of E-learning of Thai University Students

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RESEARCH OVERVIEW

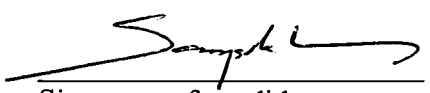
Computer, the Internet, and other electronic devices have increasingly been used as tools for searching information and inter-communication. Many universities in Thailand have increased the use of Web-based technologies to supplement the learning systems in their institutions. E-learning is becoming a factor of competitive advantages at many universities. In order to implement an effective e-learning medium as a new learning system, we have to find out how university students accept this new technology for their learning.

The purpose of this study is to examine the acceptance of e-learning by Thai university students. Technology Acceptance Model (TAM) is used as a model to investigate and find out the degree of acceptance of e-learning especially by Thai university students. Questionnaire survey is used to collect quantitative data from universities in Thailand. Students who have participated in e-learning courses from two public universities will be surveyed. Students will be randomly selected from a particular university as a sample for this survey. The general 5-point Likert scale is used as the tool of measurement. Exploratory and confirmatory factor analyses were conducted by SPSS to re-examine the structure of each exogenous and endogenous variable whereas structural equation model was employed by using AMOS version 5.0 to examine TAM in Thai context.

From students' perspective in the study, the result shows that course contents, collaborative learning, interactivity, and learning outcome are the factors that significantly influence on perceived benefit. Further, computer experience, Internet experience, technological supports, enjoyment and convenience are the factors that significantly influence on perceived ease of use. The findings show strong relationships between perceived benefit and students' attitude towards e-learning systems as well as between perceived ease of use and students' attitude towards e-learning systems. As the result of this study, students' attitude towards using e-learning systems has significantly effect on students' behavioral intention to use e-learning systems.

DECLARATION

I declare that this dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of knowledge it does not contain any materials previously published or written by another person except where due reference is made in the text.



Signature of candidate
Mr. Songsak Vanichviroon

July 6, 2005

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CHAPTER I
INTRODUCTION

1.1 Background of the Study

As information and communication technology (ICT) become an integral part of our work places, schools, and homes, they are changing the way we live, work, play, communicate, and learn (President's Information Technology Advisory Committee [PITAC], 1999). ICT as a combination of information technology (IT) and communications technology (CT) is the processing and packaging of information, and the interaction, exchange and linkage with information and databases among users via networking. In general, educators, policy makers and researchers all seem to agree on the potential of ICT to have a significant and positive impact on education (UNESCO, 2004). ICT allows us to create, collect, store, and use new knowledge and information to establish a connection with people and resources all over the world, to collaborate in the creation of knowledge, and to distribute and benefit from knowledge products (Kozma, 2003). The coverage of ICT goes beyond such activities as programming, networking and analyzing. It enables the use of computers and related tools such as the Internet to enhance the quality of learning.

The ICT Revolution, like the Industrial Revolution in the 18th century, has changed societies worldwide. While the Industrial Revolution changed agricultural societies to industrial societies (Mephokee, 2003), the ICT Revolution is going to change traditional learning into electronic learning or "e-learning". The fact that new knowledge is made available and widely disseminated through ICT can transform traditional learning into e-learning. From this perspective, knowledge is both the engine and the product of economic growth (OECD, 1999). The production, distribution, and use of new knowledge and information are major contributors to increased productivity and the creation of new, high-paying jobs. Associated improvements in manpower qualifications and institutional capabilities are, in turn, major sources of new knowledge and innovation (Kozma, 2003). Globalization plays a crucial role in integrating and converging knowledge and economic activities between developed and developing countries (Makishima and Suksiriserekul, 2003). It is crucial for people to be able to acquire new skills in response to changing circumstances, assess their own learning needs and progress, learn throughout their lifetime and become lifelong learners.

Many countries have set national goals and policies to identify a significant role for ICT in improving their education systems and reforming their curricula (U.S. Department of Education, 2000; Ministry of Education, Finland, 1999; Ministry of Education, Singapore, 2002; Ministry of Education, Thailand, 1999). For the past few decades, a growing number of educational institutions are delivering training and education by using computer and the Internet (Papert, 1980; Collis, 1993; Means and Olson, 1997; Pelgrum & Anderson, 1999). Many schools and universities are now wired to the Internet, and World Wide Web (WWW). UNESCO Asian and Pacific Regional Bureau for Education (2003) reported that there are an estimated ten million courses online, and that in the U.S. alone, there are about 700 e-learning companies. Instructors and students have gained experience with the use of ICT in the classroom. These technologies are used to enhance students with multimedia tools such as the Website and hypertext links that make subjects more understandable, electronic mail or "e-mail for communications, and collaborative learning to build knowledge among students.

Currently, prices of personal computers have significantly dropped, while the capabilities of computer have increased to include multidimensional graphics and real-time communication. As a result of this real-time communication, teaching and learning can be done through the e-learning systems. Therefore, ICT has become an important medium for teaching and learning. There are several reasons for using ICT as a tool for teaching and learning which are explained below:

First, the Internet and computer technology enable students to have interactive communication with instructors anywhere. Similarly, Morrison (2003) claims that learning is available wherever the learner needs it. Students in e-learning situations have the flexibility of learning from any place (Turban, McLean, and Wetherbe, 2004). According to Connick's report in 1999 and Matthews's study in 1999 (cited in Evans and Haase 2001, p.246), "computer and multimedia technologies are at the forefront of the distance education phenomenon today".

Second, the benefits of the Internet as a medium for teaching and learning allow students to learn at anytime and to eliminate the limitation of traditional classroom learning. Similarly, e-learning overcomes the barriers associated with time zones (Turban, McLean, and Wetherbe, 2004; Morrison, 2003). With e-learning program, learners do not have to come to the class; however, they can access information through the Web site from anywhere and participate in a class session at any time they desire.

Third, Raab, Woods, and Abdon (2003) define e-learning as Internet-enabled learning and used network technologies to create, foster, deliver, and facilitate learning. Learners can interact with the lessons and instructors through e-mail, chat rooms, Web boards and also can manage their own learning schedules. The studies of Hiltz in 1988, 1994 and Wells in 1990 (cited in Brooks, Nolan, and Gallagher, 2001) indicate that online environments facilitate learning outcomes that are equal or superior to those generated in face-to-face situations.

Furthermore, investigators at the University of Michigan argue that computer-based instruction provides higher average scores than traditional instruction (Schulman & Sims, 1999). These studies show that using Internet and computer technology for education can improve students' learning performance.

However, the definition of e-learning used in this study is *a system that is designed to electronically support, facilitate learners who need to have an effective and different kind of interaction with instructors or experts through ICT such as CD-ROM, DVD, or mobile phones as well as to provide learning materials at a convenient and accessible time and place.*

E-learning in Thailand

The Thai government fully supports the use of ICT for education. Chapter 9 of the National Education Act 1999 focuses on technology for education (The Ministry of Education, 1999). The Thai government has framed policies to support the educational development. One of these policies is to support infrastructure and networking system to distribute frequencies, signal transmission devices and other infrastructures for communication for education use. Another policy is to expand the study area so that students can learn not only from their traditional classrooms but also from anywhere, any time. To encourage educational institutions in Thailand to utilize the positive aspect of ICT, the government has introduced some IT projects.

The National Electronics and Computer Technology Center (NECTEC) initiated an IT project called the SchoolNet Project in 1996 to enable 5,000 secondary and vocational schools throughout the country to have access to information technology for the benefit of education and learning (The SchoolNet Web site, 2004). This Web site serves as the information center for teachers and students and the gateway for other school Websites in all regions in Thailand.

Another major project initiated by the Ministry of University Affairs is the development of an Inter-University Network (UniNet) in accordance with Cabinet Resolution of October 8, 1997 with the object of developing infrastructure and framework necessary for the information networking and establish a distant learning network for the Thai university system. There are currently thirty institutions which joined in the UniNet through fiber-optic network. The UniNet is composed of two major networks which are called the Bangkok Backbone and the Regional Backbone. These two will be joined to integrate the inter-and intra-university systems throughout the country.

On 18 September 2001, the Cabinet approved the creation of a National Education Network Project, or "EdNet, which merged the UniNet and SchoolNet networks. The Ministry of University Affairs was charged with the development and management of the infrastructure for the network at all levels and the ministry of Education responsible for installation of equipment and computers in the schools and learning centers in each province. The EdNet is a major project being undertaken from 2002 to 2005 with five plans: IT infrastructure development; development of e-library and e-learning centers; production of electronic media for teaching and learning; development of human resources for ICT and research; and development in international connectivity.

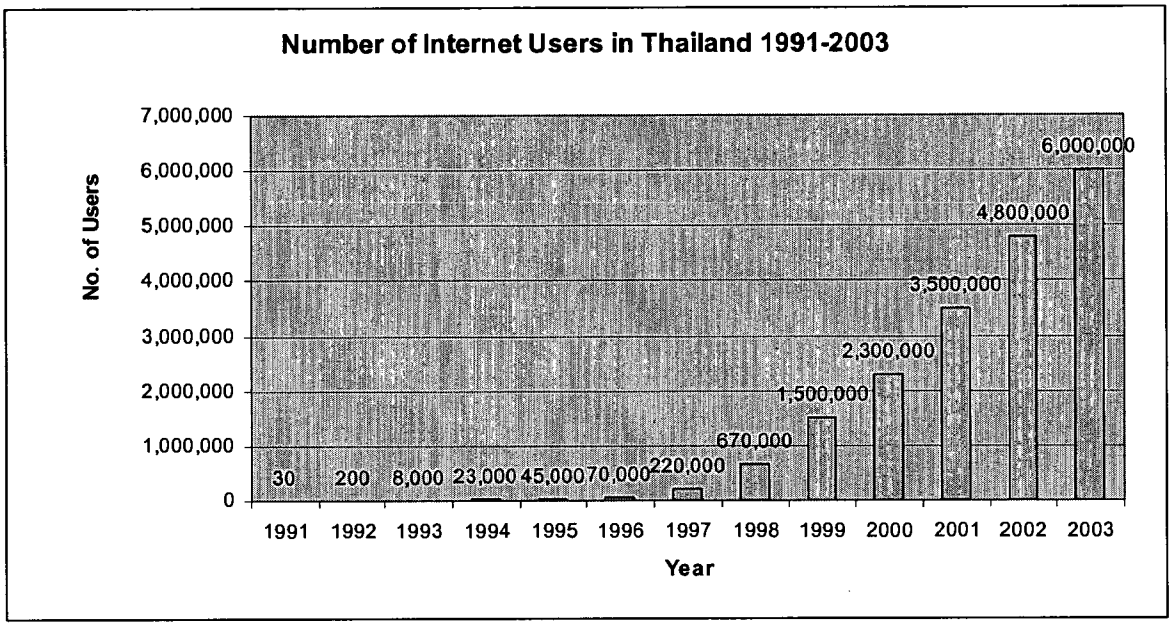
Another project is the Information Technology Campus (IT Campus) which introduces IT into the instruction process so that remote campuses can access information. This will allow campuses in peripheral regions to have improved system of virtual instruction environment to improve quality and maximize effectiveness (The Ministry of University Affair, 2001). These major projects show that Thailand has done much to develop the infrastructure and networking systems for education.

Thailand has long opened itself to the global economy. As a small developing country, Thailand plays the role of the ICT consumer that adopts this new technology to improve the quality of life (Mephokee, 2003). Moreover, Thailand also plays the role of an ICT producer; the country has been attracting foreign direct investment in the ICT industry. In order to verify the situation whether people accept e-learning systems in Thailand, the number of Internet users and the number of universities which has adopted e-learning systems are good evidence for this study.

While the Internet usage rate is increasing very rapidly in Thailand, many firms and agencies in private and public sectors are interested in developing an online

education system through the Web or using an e-learning system for teaching and training their staffs and clients. Some organizations (World Bank, 2003; UNESCO, 2003; and NECTEC, 2003) indicate that the number of computer and the Internet users have significantly increased. In addition, Figure 1.1 illustrates how the number of Internet users in Thailand has increased from year 1991 to 2003.

Figure 1.1: Number of Internet Users in Thailand 1991-2003



Source: Adopted from NECTEC (2003)

Many universities in Thailand are involved in developing e-learning courses. The Kasetsart University Learning Network is one example, where e-meetings are being held to move toward the "e-university" concept. Other examples include "Chula Online" of the Continuing Education Centre of Chulalongkorn University; Sukhothai Thammatiraj Open University, Ramkhamhaeng University (Information Technology, 2001) which has a project for foreigners who need to learn Thai language through the Internet, and Thammasat University (Higher Education Innovation Centre) as well as the University of the Thai Chamber of Commerce which are developing electronic classrooms or "e-classroom" and which aims to have 100 e-classrooms by the year 2005.

Other organizations are also developing online programs, for instance, the NSTDA Online Learning Project (NOLP) of the National Science and Technology Development Agency which operates as a commercial enterprise that aims to become self-sufficient while maintaining product quality. It is attempting to develop a virtual

university concept in the management field and implementation of the learning process. ICT skills are the initial emphasis in the area of development and use of software and contemporary information technology.

Other government projects have been implemented such as universal health care system, IT for education, and low cost Internet for universities. As discussed, many other private and public universities have established an IT infrastructure such as Internet connectivity and wireless campus. However, the problems still remain, for some institutions that are not in Bangkok and metropolitan area still have little or no infrastructure.

While the Internet usage rate is increasing very rapidly in Thailand, many universities and companies are interested in creating an online education system through the Web or e-learning for their staffs and clients. The benefits of the Internet as a medium for teaching and learning allow students to learn at anytime anywhere and to eliminate the limitation of traditional classroom learning. With e-learning, learners do not have to come to the class; however, they can access through the Web site from anywhere and participate in a class session at anytime they want.

In today's changing global environment, people rely on the use of natural resources and are more dependent on information and knowledge. World Bank (2003) reported in ICT at a glance in Thailand that the use of personal computers has increased from 14,100 people in 1995 to 27,800 people in 2001 and had installed in education from 88,900 units in 1995 to 271,500 units in 2001. Similarly, the number of Internet users has increased from 55,000 in 1995 to 3,536,000 in 2002. This can be a good evidence for the information and technology trends for the country.

The quality of higher education has become a prerequisite to national development. Shinawatra (2002) stated that advances in information and communication technology (ICT) serve as the major driving force in globalization and the formation of a knowledge-based society. ICT has an impact on all aspects of people's lives including political, social, economic, technological, and particularly educational.

Shinawatra (2002) said that education has to be a continuous or life-long process. It must be borderless and available to all, regardless of sex, age, ethnic race, religion, socio-economic status or political leanings, and also available at any time and place in various modes. Therefore, ICT can play an important role in facilitating and promoting education.

Computer simulations, virtual learning, video-audio and computer teleconferencing are some of the elements of new delivery systems. However, this new system has to be more student or learner-centered and it should be customized so that it could be made possible "just in time" learning materials for students.

The National Science and Technology Development Agency of Thailand (NSTDA) established in 1991 to develop the country's capability in science and technology. NSTDA had established the Thailand Graduate Institute of Science and Technology (TGIST) in 1997 to operate in human resource development for science and technology and to perform linkages among universities. There are two main projects initiated by TGIST which are Thailand Training Network (TTN) and Learn Online.

The TTN project provides short courses for continuing education or upgrading the skill of the workforce in business and industry by using live television broadcast via satellite (Gillotte, 2000). Fortunately, Thailand has access to domestically owned satellites operated by a Thai corporation, with an earth station located in the country for direct uplink to broadcast. The purpose of TTN project is to improve knowledge of working people who had difficulty to access to the Internet at work or at home.

However, broadcasting via satellite is a one-way system. It was too expensive and not practical for a large network of subscribers to have two-way interaction such as video-conferencing via satellite. Therefore, in this TTN project, students had to use the existing telecommunication systems for interactivity such as telephone, fax, pager, and e-mail.

Another project that was initiated by TGIST was called "Learn Online" or www.learn.in.th. This project mainly was Internet based e-learning, which was produced in cooperation with the Graduate School of Mahidol University. The online courses such as Bioinformatics and Cybertools for Research were designed for post graduate students. It is necessary for the graduate students to learn how to use the Internet and the computer in studying these subjects as well as digital library and web search. According to this project, Krairojananan et al. (2002) noted that e-learning is well accepted and can be made an efficient instrument for continuing education and lifelong learning. However, the problem may be the false assumption that Thai people are very eager to learn and are ready for lifelong learning.

There are some other concerns about promoting technological learning for Thai students. A study of Mauleon (2003) provided more details of elements of computer learning test conducted in villages in the northeast of Thailand as follows:

- Attitudes to computer learning: many younger learners in Thailand did not understand the importance of using computer or how computer skills might be useful later in life. They perceived project related to computer as additional works from school. However, they would be more willing to join when motivation was based on social and computer fun.
- Cultural aspects: Thai people generally show respect for authority, elders, monks, parents and teachers. It is not usual to question someone who holds a higher position than you. That is the limitation of modern teaching and learning method.
- Attitudes to new technology and pedagogical methods: some younger learners did not perceive computer demonstrations as a learning tool. Meanwhile, some adult learners had difficulties understanding the contents.
- Social aspects in the learning environment: Social environment in the village, home, and school are also another important factor to learning. In the study, researcher observed that some learners were diverted to other tasks, to help in the farm, to play football or discouraged by elders who believe computer learning is a waste of time.
- World awareness: Most learners are ignorant about the outside world. It is difficult to motivate them to learn with computer. Few have a good understanding of the outside world. Many elders prefer to continue their traditional life styles although they welcome a better standard of living, more social security and better health care as well as modern technologies such as car and mobile telephones, they find it difficult to link between more education such as computer knowledge and a higher standard of living.
- Technology issues: Learners are familiar with basic concepts of the computer since they have the interest in CD-ROM, Web, and Game. However, there are some places that do not have Internet access which is the barrier to e-learning.
- Language: Language is not an obstacle for starting computer learning processes but it can be a barrier when students learn more complicated tasks.
- Interaction and cooperation: Learning has tended to be individual with boys but girls were more willing to help each other. However, interaction and cooperation would be encouraged in e-learning to share information and develop society.

E-learning in Thailand currently is in the beginning stage. Most of the Web sites do not provide a complete list of online education services because they do not have adequate resources such as Internet infrastructure, IT people, and budget for technology. Some of the universities claim to have an e-learning program but they actually have only PowerPoint slides on their Web sites. However, e-learning will be continuously developed to provide a complete service of online education.

In this study, Technology Acceptance Model (TAM) is used as the baseline model to investigate the attitude of university students toward e-learning and how they accept the existing e-learning system. It is important to understand the reason why TAM model has been used widely in the areas of information technology and information systems.

1.2 Statement of the Problem

If e-learning has good impact on the learning process why it has not been accepted. In order to implement an effective e-learning medium as a new learning system, we have to find out how university students accept this new technology for their learning. The objective of this study is to explore and investigate the critical success factors related to e-learning and also provide the framework on a literature review related to e-learning and the attitude towards e-learning system. Moreover, the study is to clarify the different meanings of the related terms distance learning, e-learning, Web-based instruction (WBI) learning, Internet learning, and computer-assisted instruction (CAI), which sometimes are confused. Furthermore, the differences between e-learning and traditional learning, critical success factors, and issues of e-learning will also be discussed.

In pursuance of the above objectives, this study will try to answer the following questions:

1. How has distance learning, Web-based instruction (WBI), computer-assisted instruction (CAI), and e-learning been defined?
2. What are the differences between traditional learning and e-learning?
3. What are the key success factors underpinning e-learning?
4. What critical factors influence the attitude of students towards e-learning?
5. What effects do course contents, interactivity, collaborative learning, and learning outcome have on perceived benefit?

6. What effects do computer experience, Internet experience, technological supports, enjoyment, and convenience have on perceived ease of use?
7. What effects do perceived Benefit and perceived ease of use have on attitude toward using e-learning?
8. What effect does attitude toward using e-learning have on behavioral intention to use e-learning?
9. What effects do peer, student' s parents, cost and fees, reputation of university, accreditation of university, and lecturer have on behavioral intention to use e-learning?

The outcome of this study will shed light on e-learning particularly in the Thai context. In reviewing literature as well as content analysis from various documents, a framework for e-learning was derived. A proposed model was used to investigate student's acceptance of e-learning for Thai universities in the later stages.

1.3 Research Objectives

To respond to the research problems, the following main objectives were developed. The research design was formulated to address each of the objectives stated below:

- To study the correlation between course contents, collaborative learning, interactivity, and learning outcome and perceived benefit.
- To study the correlation between computer experience, Internet experience, technological supports, enjoyment, and convenience and perceived ease of use.
- To study the correlation between perceived benefit, and perceived ease of use and attitude towards using e-learning systems.
- To study the correlation between attitude towards using and behavioral intention to use of e-learning systems.
- To study the effect of social influences on the relationship between attitude towards using and behavioral intention to use of e-learning systems.

1.4 Scope of the Research

The main focuses of this research study are:

1. The research study is to test the relationship between course contents, collaborative learning, interactivity, and learning outcome and perceived benefit as well as the relationship between computer experience, Internet experience, technological supports, enjoyment, and convenience and perceived ease of use. Meanwhile, this study is also to test the relationship between perceived benefit, and perceived ease of use and attitude towards using e-learning systems along with the relationship between attitude towards using and behavioral intention to use of e-learning systems. Moreover, this study will test the effect of social influences on the relationship between attitude towards using and behavioral intention to use of e-learning systems.
2. The respondents in this study can be both male and female who are studying in undergraduate or graduate courses in their universities in Thailand.
3. In this study, the respondents are asked to rate their perception on a set of variables such as course contents, collaborative learning, interactivity, learning outcome, computer experience, Internet experience, technological supports, enjoyment, and convenience, how their attitude is toward the e-learning systems, and the degree of behavioral intention to use e-learning systems in the future.

1.5 Limitation of the Research

1. The limitation of this research study is that the respondents had used only some parts of e-learning systems such as checking class assignment, announcements, communicating with instructors and their classmates, downloading PowerPoint, and other files for the subjects, and searching for information because e-learning in Thailand is just in the initial stage.
2. The place of study is limited to only Thailand; therefore the findings may not be generalized for other countries.

1.6 Significance of the Study

The result of this study will be beneficial for academic institutions who are interested to invest in e-learning systems in order to enhance students' learning in Thailand. This study will help e-learning implementers in higher education to understand students' acceptance of new information and communication technology in facilitating them to learn. The students' attitude towards using e-learning systems should be favorable and a favorable attitude can be created by students' perception of benefit and ease of use of e-learning systems. Furthermore, a favorable attitude can create behavioral intention to use e-learning. It means that students will accept e-learning systems as long as they use it. Therefore, before investing a big amount of money for implementing e-learning systems, academic institutions have to understand the students' acceptance of e-learning.

This study has contributed to the knowledge of the acceptance of e-learning in both general and specific context in Thailand. It also raises awareness among and across researcher and scholars in viewing e-learning from students' perspectives. This study will put learners at the heart of e-learning issues.

CHAPTER II
REVIEW OF RELATED LITERATURE AND STUDIES

This chapter is intended to review literature relevant to the topic of the study and to build up a research framework and it is divided into four main sections. The first section reviews the relevant types of distance learning environment. The second section reviews the definitions of e-learning. The third section focuses on the differences between traditional learning and e-learning. The fourth section emphasizes on the level of e-learning implementation. The researcher based mainly on previous researches as source of variables regarding the studied variables with the support of relevant theories.

2.1 Types of Distance Learning Environment

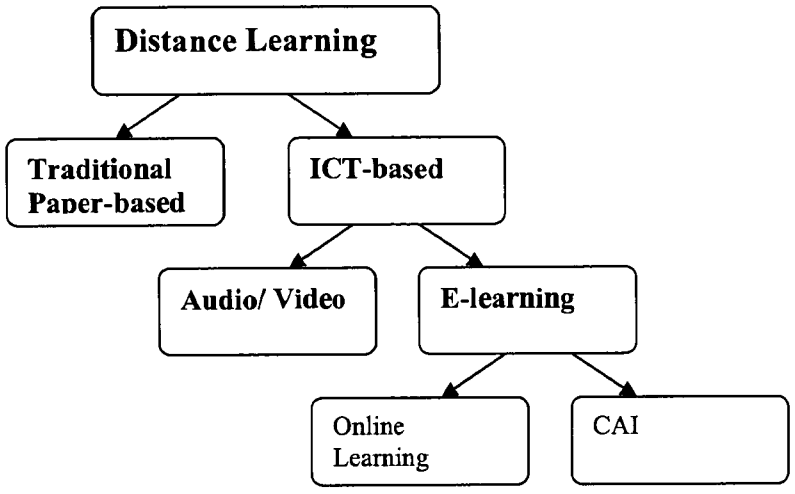
In general, the terms e-learning, online learning, Web-based learning, Internet learning, computer-assisted instruction, and distance learning are used interchangeably. There must be some explanation to classify these terms. On the one hand, many people perceive the terms as analogous to one another. On the other, it is not clear about the meaning of these terms: e-learning, online learning, Web-based learning, Computer-Assisted Instruction learning, and distance learning or even these terms can be related to one another. Both the former and the latter can create confusion among us.

In this section, it is important to distinguish distance learning environment, Computer-Assisted Instruction, Web-based instruction, and e-learning because there are some confusion and overlap function among those types. There should be initial clarification to allow us to gain fundamental understanding of terminologies used in the study.

Figure 2.1 demonstrates the different types of distance learning environment: CAI, online learning, e-learning, and distance learning. Distance learning in general can be classified into traditional paper-based distance learning and ICT-based distance learning. In this study, ICT-based distance learning will be focused as the use of technology and computer are increasing dramatically. ICT-based distance learning also classified into video and audio distance learning and e-learning which will be mainly emphasized as the integration of Internet and electronic devices in this study. Online learning and computer-aided instruction learning are parts of e-learning. Both of these two types of distance learning are ICT-based. Online learning is using computer network and Internet technology but CAI is a special system without computer network

and Internet technology. With these technologies, students can learn any time they want to learn and from any places where they have electronic devices. Therefore, distance learning, video and audio distance learning, computer-aid instruction learning, online learning, and e-learning can be described as follows.

Figure 2.1: Types of Distance Learning Environment



Source: Developed for this study

2.1.1. Distance Learning

It can be said that e-learning evolved from the concept of distance learning, which was the oldest and original idea for students who experienced difficulties in coming to university campuses. Volery and Lord (2000) define distance learning as any approach that replaces the same-time, same-place, face-to-face environment of a traditional classroom. In the past, some students, who wanted to get a bachelors degree but did not have time to attend classes at a university campus or if the university was very far, could enroll for a program in distance education. Sukhothai Thammathirat Open University in Thailand has the highest number of university graduates (Olsen, 2000). Students can control their pace of learning. For instance, from the late 1800s to the early 1900s, written materials sent through the mail were the primary method of distance learning, and then radio and television came into play and captured the attention of many as a new way of delivering educational programs (Steiner, 1995; Evans and Haase, 2001; and Definitions, 2003). Because of the ways in which distance learning has been defined and understood, course materials and contact with instructors

heavily depend on traditional means such as print, telephone, radio and television. However, those methods of learning mostly involved one-way communication.

2.1.2 Traditional Paper-Based Distance Learning

Distance learning is the teaching and learning situation where teachers and students do not meet face-to-face. Turban, McLean, and Wetherbe (2004) noted that the oldest way was correspondence where all communication was done by regular mail. Learners and instructors have to send and receive documents in the form of paper by mail. There was no electronic device or technology for instance computer and Internet technology used for education in the old day.

2.1.3 ICT-Based Distance Learning

Later, there are some development of technology used in communication and education. Audio, video and radio are used in distance learning. Jeffcoate (1995) stated that e-learning courses are based on text that supported by a wide range of other media such as audio and videotape, radio and television broadcasts. In this study, there will be some explanation about distance learning, which integrated information and communication technology (ICT). ICT-based distance learning can be classified into video and audio distance learning and electronic learning.

2.1.4 Video and Audio Distance Learning

As the technology improvement for communication, we can use some electronic devices for supporting education. In the early 1920s, the radio was added to support distance learning (Turban, McLean, and Wetherbe, 2004). Then voice cassettes, vedio tapes, and television were used to deliver lectures to learners in distance learning. It is very useful and convenient for learners in remote areas to learn. Television and video have been used in many levels of education for many years. Caladine (1999) noted that Television and video are used to deliver educational course material, especially in distance education, open, and flexible learning programs. It proves that they are useful for teaching and learning.

However, it can help facilitate learners in a distance to gain more knowledge, these technologies are one-way communication. Learners could not interact with instructors through these types of technologies. They still had to use traditional paper-

based to communicate with lecturers, to submit assignments, to ask some questions or to take examination.

2.1.5 Electronic Learning (E-learning)

This type of distance learning environment is e-learning which uses both Internet technology as well as electronic devices such as Compact Disc-Read Only Memory (CD-ROM), Digital Video Disc (DVD), or mobile phones to transfer knowledge more efficiently. Stockley (2003) defined e-learning as the delivery of a learning program by electronic means. Raab, Woods, and Abdon (2003) described e-learning as the use of network technologies to create, foster, deliver, and facilitate learning, any time and any place that has the Internet access. With e-learning, instructors can communicate with learners more easily and learners can access educational or learning materials on demand. Fletcher in 1996 (cited in Morrison, 2003) argues that e-learning enables a learner about three times faster. Once e-learning has been delivered to learners, learning happens as fast as possible.

2.1.6 Online Learning

The Internet and Web technology mainly has been brought into this type of distance learning environment. Web-based instruction (WBI), Web-based learning (WBL), and online learning are learning environments that use Internet technology to allow students to learn mainly via the Internet, Intranet, or Extranet. Kaplan (2003) defined WBT as delivery of educational content via a Web browser over the public Internet, a private Intranet, or an Extranet. WBT often provides links to other learning resources such as references, email, bulletin boards, and discussion groups. One of the most common tools used in online learning is e-mail which allows learners and lecturers to communicate with one another. WBT also may include a facilitator who can provide course guidelines, manage discussion boards, and deliver lectures. However, online learning can be successfully implemented if learners participate in online classes or have a clear interaction process between learners and lecturers.

2.1.7 Computer-Aided Instruction (CAI) Learning

This learning approach has brought about computer as a new technology into education. What is computer-aided instruction (CAI)? Kaplan (2003) defined CAI as the use of a computer as a medium of instruction for tutorial, drill and practice,

simulation, or games. According to Kaplan's definition, CAI is used for both initial and remedial training. The other terms such as computer-based instruction (CBI), computer-aided learning (CAL), computer-based training (CBT), and computer-based education (CBE) are used in the same sense. These are learning approaches that utilize computer as the medium of teaching and learning. A study of Baek and Layne in 1988 show that CAL can enhance students learning when integrating multimedia contents such as still graphics and animated graphics, not just text. As in 1990s, the government in many countries such as France, Spain, and the United Kingdom sponsored to get CD-ROM drive into schools (Jeffcoate, 1995). They have promoted the use of CD-ROM and multimedia to allow learners to access to source material such as newspapers, not rely on only teachers' opinions and textbooks. Furthermore, the results from their study show that the scores of students in animated graphics group are significantly higher than the scores of students in still graphics group. Meanwhile, the scores of students in still graphics group are significantly higher than the scores of students in the text group. This study shows that using CAL in education can improve students' learning performance.

In defining what is e-learning, this section illustrates e-learning as part of ICT-based distance learning and classifies e-learning into two different types as earlier elaborated. However, there are many questions unanswered. How is e-learning different from traditional learning? What issues have been identified? What recommendations can apply to e-learning in Thailand? And what are the related critical success factors underpinning e-learning?

2.2 Definitions of E-learning

E-learning programs have spread rapidly in many countries. Consequently, the opportunities for using them have also increased. Many authors have defined the word e-learning differently. In this section, it is useful to explain what an e-learning is and what the similarities and differences are.

There are a number of definitions in the literature related to e-learning. These definitions can be divided into two categories: technological definition and instructional definition. For the technological category, Stockley (2003); E-learningsite.com (2003); Hicks (2000); Skill and Education Network (2003); and Jugon (2003) shared similarities in defining e-learning in general as the delivery of a learning or educational program by electronic means. Furthermore, Stockley (2003) and E-learningsite.com (2003) argue

that e-learning involves the use of a computer or electronic devices such as CD-ROM, DVD, or even a mobile phone in some way to provide educational or learning material on demand. Similarly, Morrison (2003); Skill and Education Network (2003) define the same meaning of e-learning but they include the Internet, Intranet, computer-based technology, or interactive television that can help learners study more effectively.

For the instructional category, Jugon (2003) defines e-learning as a method to deliver individualized, comprehensive, dynamic learning content in real time, aid the development of communities of knowledge, and link learners with instructors. With e-learning system, learners can discuss with instructors when they have problems related to the course. Furthermore, it is useful that e-learning courses have an expert in specific area to share ideas and information in the real business experience.

Moreover, an e-learning system is the use of electronic technology to support traditional methods of learning, for example using electronic whiteboards or video conferencing (Skill and Education Network, 2003). With these tools, learners can interact with instructors in the same way as they do in a classroom. However, a continuing education group at the University of Wisconsin-Extension (Definitions, 2003) noted that e-learning is designed to encourage learner interaction. It is useful for instructors to use the e-learning system as a way to encourage learners to study at the same or different times.

Therefore, the definition of e-learning used in this study is *a system that is designed to electronically support, facilitate learners who need to have an effective and different kind of interaction with instructors or experts through ICT such as CD-ROM, DVD, or mobile phones as well as to provide learning materials at a convenient and accessible time and place.*

2.3 Traditional Learning versus E-learning

This section is intended to provide fundamental understanding of traditional learning and e-learning as emerging technologies and tools. The findings of this study can provide new insights into the complex educational practice that constitute an increasingly technologically mediated learning environment.

Recently in Hong Kong, a study of 18 computer-using schools found that while some school teachers integrate ICT into their traditional teaching role; other teachers see the use of ICT as an opportunity to move from the role of information provider to one in which they support the learning of students (Law et al., 2000). Banathy, 1994;

and Reigeluth, 1994 (cited in Khan, 1997) noted that traditional learning has been considered a major cause of a dysfunctional and an obsolete educational system. Also, to gain competitive advantage, many universities have adopted new technologies such as multimedia, CD-ROM, DVD, telecommunications and Internet technologies. These new technologies are used to transmit knowledge from lecturer to learners with more meaningful education at a distance. The term e-learning gives new opportunities to increase flexibility in time and location of study in forms of communication (asynchronous discussions) and types of interactions such as real-time chat room (Littlejohn, 2003).

Online learning environment (CATL office, 2002) is one that goes beyond the replication of learning events that have traditionally occurred in the classroom and are made available through the Internet. Evans and Fan (2002) outlined six key advantages of online learning over formal lectures as follows: learner determined location for learning, learner determined time of learning, learner determined pace of learning, learners can review and revisit materials, learners can check their understanding through self-assessment, and learners can skip material that they are already familiar with.

With the Internet technology, learners also can interact with the lessons and instructors through e-mail, chat room, Web board and also can manage their own learning schedule. Novak et al. (1999) said that the combination of high-speed communication on the Web and the ability to rapidly adjust content will make classroom activities more efficient and more closely tuned to the learners' needs. Furthermore, a study of Chute et al. in 1999 (cited in Evans and Haase, 2001) claimed that there is no real difference in achievement in well-designed distance programs compared to those in on-campus courses, based on standard measurement in that learners have to be active learners and responsible for themselves to learn.

Volery and Lord (2000) claimed that online delivery facilitate distance education by making course material accessible anytime anywhere and provide substantial advantages over traditional technologies such as collaborative tools and interactive tools. However, a study of Wetzel et al. in 1994 (cited in Volery and Lord, 2000) reported that there is little or no difference in student performance between educational television and face-to-face instruction. Similarly, a study of Storck and Sproull in 1995 (cited in Volery and Lord, 2000) indicated that video instruction and face-to-face instruction provided little or no difference in learning results of students.

Moreover, it is important to consider both advantages and disadvantages of online learning for both instructors and students who are interested in online learning to be prepared to face the challenge of new environment as well as embrace the new opportunities that it has to offer. There are many reasons why online courses are rapidly becoming popular in higher education today. The online environment offers unprecedented opportunities for people who would otherwise have limited access to education, as well as a new paradigm for educators in which dynamic courses of the highest quality can be developed (Illinois Online Network, 2003).

In order to provide the strengths and weaknesses of online learning, Illinois Online Network (2003) lists eight major benefits of online programs. The online learning must function any place and anytime or pace, create synergy, promote high quality dialog, emphasis student centered, eliminate discrimination, access to resources, and provide creative teaching.

- **Any Place**: The primary advantage of e-learning with asynchronous online learning.
- **Any Time or Pace**: Learners can log on to their courses, access lectures, course materials, and class discussions at their own convenience.
- **Synergy**: E-learning can add a high level of dynamic interaction between the instructor and students and among the students themselves
- **High Quality Dialog**: Within an online asynchronous discussion structure, the learner is able to carefully reflect on each comment from others before responding or moving on to the next item.
- **Student Centered**: Within an online discussion, the individual student responds to the course material and gives comments to other students.
- **Non-Discrimination**: Discriminating factors such as age, dress, physical appearance, disabilities, race, and gender are eliminated.
- **Access to Resources**: It is easy to invite distinguished experts or students from other institutions in an online class as well as allow students to access resources and information anywhere in the world.
- **Creative Teaching**: focus on the use of interactive learning environments as a contribution to self-direction and critical thinking.

On the other hand, the weaknesses of online learning can be categorized into six categories as follows (Illinois Online Network, 2003):

- **Technology**:
  - *Equity and accessibility of technology*: if students cannot afford the technology the institution employs, they are lost as customers.
  - *Computer Literacy*: both students and facilitators must possess a minimum level of computer knowledge in order to function successfully in an online environment.
  - *Limitation of Technology*: user friendly and reliable technology is critical to a successful online program.
- **The Students**: an online method of education is a highly effective medium for the mature, self-disciplined student. In other words, it is an inappropriate learning environment for more dependent learners.
- **The Facilitator**: If facilitators are not properly trained in online delivery and methodologies, the success of the online program will be compromised. The administration and faculty, administrators and/or faculty members, who are uncomfortable with change and working with technology or feel that online programs cannot offer quality education, often inhibit the process of implementation.
- **The Online Environment**:
  - *Levels of Synergy*: in larger classes (20 or more students), the synergy level starts to shift on the learning continuum until it eventually becomes independent study to accommodate a large class.
  - *What should not be taught online*: it is important to recognize that some subjects should not be taught online because the electronic medium in its current state of development does not permit the best instruction. Examples are hands-on subjects such as public speaking, surgery, dental hygiene, and sports, where physical movement and practice contribute to the achievement of the learning objectives.
- **The curriculum**: E-learning curriculum must reflect the use of dialog among students (in the form of written communication), and group interaction and participation.

Table 2.1 adopted from Morrison in 2003 demonstrates that student-centered, constructivist and collaborative learning is more effective learning environment than traditional learning environments

Table 2.1: The Differences between Traditional Learning and E-learning Environment

Face to face Learning Environments	E-Learning Environments
Single-sense stimulation	Multisensory stimulation
Single-path progression	Multipath progression
Standardization	Customization
Isolated work	Collaborative work
Information delivery	Information exchange
Passive learning	Active learning
Factual, knowledge-based learning	Critical thinking and informed decision-making
Reactive response	Proactive/planned action
Isolated, artificial context	Authentic, real-world context
Conformity	Diversity
Teacher as "King"	Learner as "King"

Source: Adopted from Morrison (2003)

However, e-learning is not a cheap program and not all universities have succeeded in e-learning programs. Even though online learning is an exciting development in education, instructors who want to deploy e-learning as a new way of learning must consider these strengths and weaknesses of online learning. However, the success factors that are important to e-learning program should be selectively considered to match particular environments.

2.4 Levels of E-learning Implementation

E-learning has its pace of implementation. Different educational institutions are not engaged in e-learning implementation at the same pace. To perceive better understanding of its implementation, this section will illustrate different levels of e-learning operational stages. Based on Figure 2.2, e-learning can be categorized into three levels for teaching and learning: supplementary, complementary, and comprehensive replacement (Laojaratsaeng, 2004). It depends on the readiness of the institutions such as lecturer, students, technological infrastructure, and budget.

2.4.1 E-learning as Supplementary Resources

With the e-learning as supplementary resources, usually learners still have to come to the campus to learn. However, if learners cannot come to campus, they can get the same learning materials that are provided from traditional learning in e-learning systems. For instance, learners can download course outline, class schedule, handouts or some articles from the classroom website or watch videotapes that are previously recorded on the Internet. With this level of e-learning implementation, the lecturer has to find the way that learners can easily access his/her learning materials.

Many institutions have been integrating e-learning programs, or at least using the Internet technologies, as a supplementary resource to their courses. Moreover, a study on the use of supplements in Poe's chemistry class in 1999 reports that a positive relationship between use of supplements and success in an introductory course. However, Evans and Haase (2001) claimed that the percentage of institutions using asynchronous Internet-based technologies nearly tripled from 22 percent in 1995 to 60 percent in 1997-98. AACSB's study in 1998 (cited in Evans and Haase 2001) reported that Duke and MIT are increasing the legitimacy of distributive education by investing significant resources to provide courses to distant students in the US and overseas.

2.4.2 E-learning as Complementary Resources

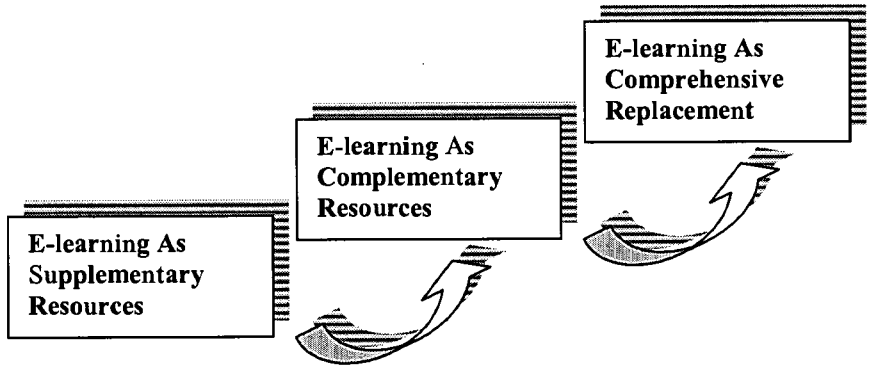
With e-learning as complementary resources, learners still have to learn in the classroom on campus but the lecturer has to design other learning materials for learners to look for more information related to the topic or lesson in the course. For example, a lecturer may provide some more information on Web sites for learners to explore because the Web is a remarkable, evolving communication tool and allows dynamic, interactive communications (Brooks, Nolan, and Gallagher, 2001). Similarly, Morrison (2003) noted that blended learning is the use of both Internet-based and traditional media to deliver learning. Further, in e-learning as complementary resources, lecturers can interact with learners asynchronously using discussion boards or Webboard. Learners can understand more about the topic or lesson when they search for more information on those Web sites.

Laojaratsaeng (2004) suggests that any educational institutions, which want to adopt e-learning system, should apply it as complementary resources. It is better than adopting it as supplementary resources since it is appropriate to Thai students who do not possess high self-efficacy. Blended learning allows higher education institutions to gradually move learners from traditional classrooms to e-learning in small steps to make change easier to accept (Morrison, 2003). However, many resources that created by lecturers for their own sites such as some useful Websites that related to the courses and publisher Websites (Brooks, Nolan, and Gallagher, 2001) that provide more information intended to be used with particular texts are considered as complementary resources. Information from websites can help learners in understanding a particular concept and learners can ask a question whenever they have problem related to the subject through discussion boards.

2.4.3 E-learning as Comprehensive Replacement

Using e-learning as comprehensive replacement, learners can find all materials online or in electronic formats such as CD-ROM, DVD. Learners do not have to come to the university campus. Currently, most e-learning courses are implemented in developed countries such as the United States, some European countries, and Australia. The objective of e-learning as comprehensive replacement is to use e-learning as the main tool for teaching at a distance with expectations that e-learning can transfer knowledge to learners as lecturers do in traditional classroom. Students in e-learning situations have the flexibility of learning from any place, at any time, and at their own pace. Students appreciate what they perceived as the risk-free environment offered by e-learning, in which they feel free to express themselves (Turban, McLean, and Wetherbe, 2004). Currently, e-learning particularly in Thailand is at the initial stage. Some universities have implemented e-learning as supplementary resources or complementary resources. However, there is little evidence that e-learning as a comprehensive replacement has been implemented successfully in Thailand.

Figure 2.2: Levels of E-learning Implementation



Source: Developed for this study

To develop a successful e-learning system, it is important to understand the critical success factors to implement an effective e-learning course in general. Also, it is necessary to understand the current situation and issues particularly in Thailand. However, the definitions of attitude and its components will be discussed in the next section because the success of e-learning depends on the acceptance and attitude of users or students in e-learning systems. Therefore, the attitude models will be described and at a later stage, this study will explain the students' attitude towards e-learning course.

2.5 Attitude towards E-learning

In this section, students' attitude toward e-learning program will be explored before implementation of e-learning as otherwise, this big investment would not be effective. The success of e-learning implementation depends as much on individual differences as on the technology itself (Harrison and Rainer, 1992; Nelson, 1990; Zmud, 1979). The theoretical relationship between individual differences and their beliefs are discussed in social psychology and learning theories. According to a study of Fishbein and Ajzen, 1974 (cited in Hartwick and Barki, 1994), attitude refers to the affect that one feels for or against some objects or behaviors. They categorize attitude into two different kinds: attitude towards objects and attitude towards behaviors. However, they argue that attitudes toward objects are not strong in predicting specific behaviors toward such objects. Furthermore, they stated that an individual's attitude toward a behavior is determined by the set of salient beliefs that he or she performs the behavior. Salient beliefs are a small number of beliefs which may be around five to nine that a person can attend to at any given moment. Moreover, Fishbein and Ajzen (1975) define subjective norm as a person's perception that most people who are important to him or her think he or she should or should not perform the behavior.

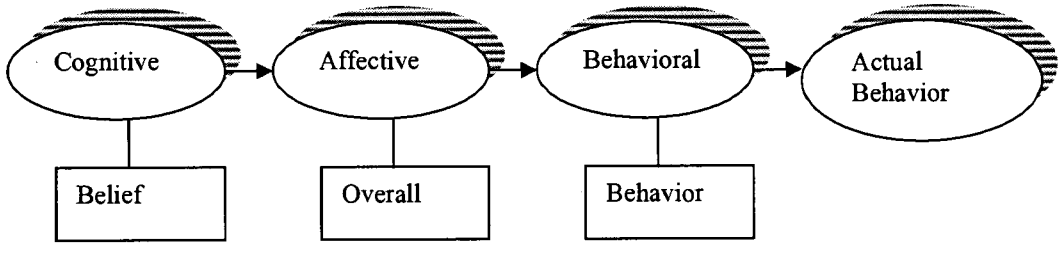
Different authors give different definitions of the term attitude. For instance, in the early 19th century, Morgan (1934) views attitude as literally mental postures, guides for conduct to which each new experience is referred before a response is made. Similarly, Bogardus (1931) states that an attitude is a tendency to act toward or against something in the environment, which becomes thereby a positive or negative value. Both scholars define attitude towards behavior to act and react in different environments. The notion of attitude definition has evolved over many decades. In 1995, attitudes are seen as consumer learned tendencies to evaluate brands in a consistently favorable or unfavorable way (Assael, 1995). In other words, attitude refers to the core of our likes and dislikes for certain people, groups, situation, object, and intangible ideas (Mowen and Minor, 1998). The former definition of attitude is to act or react in different settings. The latter is the attitude evolved to our core of our likes and dislikes both favorable and unfavorable objects. Recently, attitude can be defined as a learned predisposition to behave in a consistently favorable or unfavorable way with respect to a given object (Schiffman and Kanuk, 2000). In the same fashion, attitude is defined as an enduring combination of motivational, emotional, perceptual

and cognitive processes with respect to some aspect of our environment (Neal, Quester, and Hawkins, 2002).

On a physiological basis, attitude or preparation before or the actual response, constitutes an important determinant of the ensuing social behavior. Cantril (1934) described that a permanent enduring state of readiness of mental organization, which predisposes an individual to react in a characteristic way to any object or situation which it is related. Rosenberg and Hovland et al. (1960) stated that attitude can be used to predict behavior and behavior can be used to infer the underlying attitudes. In order to predict the behavior of a consumer, attitude and its components can be investigated. In order to apply the theory of attitude to predict behavioral intention to e-learning of students, it is necessary to understand the clear definition of attitude, its components, and why it is important in predicting the future behavior.

One of many theories is "the traditional model", which addresses the effect of attitudes on behavior. This model consists of three main components, which are cognitive, affective, and behavioral as shown in Figure 2.3.

Figure 2.3: Three Components of Attitude



Source: Adapted from Engel (1993)

2.5.1 Cognitive

The first component of the attitude model consists of a person's cognition that is knowledge and perceptions that are acquired by a combination of direct experience with the attitude object and related information from various sources. Bednar and Levie (1993) showed an individual's attitude toward the police which may involve beliefs about the honesty, effectiveness, and attitudes of police officers. Cognitions are teachable, and attitudes are learned. Students' attitude towards e-learning can be measured from how students perceived e-learning systems.

2.5.2 Affective

The second component of the attitude model is a person's affect. The affective component represents a consumer's emotions or feelings about a particular product or attitude-object as favorable or unfavorable. Bednar and Levie (1993) pointed that the most fundamental aspect of the concept is the emotional approach-avoidance tendency. The affective evaluation of an object can be positive or negative or in degree, the amount of positive-negative (from strongly positive to strongly negative). However, these affective reactions serve as implicit responses to objects that motivate this behavior. Students who have participated in e-learning class may have positive feeling about e-learning systems. They might be the possibility to continue to intend to enroll another e-learning class.

2.5.3 Behavioral

Behavioral component is concerned with the likelihood or tendency that an individual will undertake a specific action or behave in a particular way with regard to the attitude object. This can be said that students who participated in e-learning class have good feeling about e-learning systems. They finally will take other classes as e-learning classes. Figure 2.3 describes the conceptualizing attitudes as possessing three different components; attitudes are restricted to only the affective component while the remaining components related closely to attitudes, are viewed as distinct entities. The elements of the cognitive component are seen as a major determinant of the evaluations comprising the affective component, which is positioned as influencing the behavioral component. The behavioral component is viewed as the immediate determinant of actual behavior.

Similarly, Neal, Quester, and Hawkins (2002) illustrate the traditional view of attitude that affect towards an object is mediated by cognition or emotional response about an object that is controlled to a market extended by rational evaluation. An attitude contains components that show whether the existence of an attribute will lead to satisfaction or dissatisfaction.

Solomon (2002) note that attitude is lasting because it tends to endure overtime. This means that attitudes are relatively stable and resistant to change. The other authors suggest that all three attitude components tend to be consistent which means that a change in one attitude component tends to produce the other components (Neal, Quester, and Hawkins, 2002). However, Bednar and Levie (1993) note that attitude is a

latent variable which is not directly observable but is inferred from behavior, such as verbal statements or observable actions.

In literature review, the attitudes of students toward instruction can affect instructional effectiveness and efficiency. Many evaluations of technology-based instruction simply ask students if they prefer it to more conventional classroom approaches. Greiner (1991) reviews these evaluations and found that typically 70 to 80 percent of students who were polled preferred technology-based approaches over others. Students who reported a non preference for technology-based instruction usually cited implementation or technical problems with the technology, not the instructional approach itself.

A study of the attitude toward technology from students aged 11-15 years of Bame, Dugger, de Vries, & McBee in 1993 (cited in Becker & Maunsaiyat, 2002) claims that understanding of technological knowledge and attitudes toward technology is a prerequisite to effective teaching and learning using e-learning. Moreover, McKinnon, Nolan, and Sinclair (2000) completed a three-year study of student attitudes toward the use of technology-based learning and productivity tools such as spreadsheets, databases, graphics, desktop publishing, and statistical processing. The attitudes of the students toward technology use slackened as the novelty of the technology wore off. However, their attitudes remained positive and significantly more positive than those of students who did not use technology.

However, there is no study on the attitude toward e-learning of Thai students in higher education. Hence, this study will focus on the attitude of Thai university students toward e-learning. In e-learning environment, students must be a major potential stakeholder in terms of the system utilization because they are always recipients of the creation of e-learning system. In addition, students are engaged in changing world which requires them to participate in high productive economic growth. Given the focus of this paper is in Thai context, Thai students are the main target to reflect their attitude toward e-learning because they are the key stakeholders as mentioned earlier. In order to understand students' attitude toward e-learning, behavioral intention to use e-learning system in the future will be examined according to Technology Acceptance Model (Davis, 1989, 1993; Davis, Bagozzi, and Warshaw, 1989; Venkatesh, 2000). Prior to presenting the characteristic of TAM, critical success factors for e-learning and its current issues must be examined because these factors will

incorporate in constructing a theoretical framework to grasp students' attitude toward e-learning.

2.6 Critical Success Factors for E-learning

It is important to describe what factors indicate successful e-learning. The studies of Shirley in 2001 and Alstete in 2001 (cited in Metaxiotis, Psarras, and Papastefanatos, 2002) showed that although e-learning environments can be used widely either for educational or for training purposes, problems which still exist are the efficient management of the content and the effectiveness to the users.

According to the studies of Dillon and Gunawardena in 1995 and Leidner and Jarvenpaa in 1993 (cited in Volery and Lord, 2000), three main variables, which affect the effectiveness of online delivery, are technology, instructor characteristics, and student characteristics. Similarly, Morrison (2003) points that content, technology, and services are the three key elements for effective e-learning implementation. These factors are significantly important for an effective e-learning initiative. According to their research, there are two weaknesses in the part of methodology. First, the grade of each individual student, which was the factor to measure effectiveness, was not available at the time the questionnaire was administered. Second, the sample size of 47 students was too small.

If a higher education institution wants to deliver an effective e-learning system, it has to use Internet technology as a communication tool among students and instructors. In terms of an effective communication tool, Evans and Haase (2001) clearly state that students have easy access to the technology selected as the primary method of delivering course.

The study of University of Texas in 2000 (cited in Evans and Haase, 2001) argues that the factors to be closely considered by a qualified designer are the content to be delivered, the characteristics and capabilities of the audience, and the proposed learning outcomes. A study of Schuemer in 1993 (cited in Szeto, 2002) suggests that three important elements in any successful distance education program are content, technology, and support. However, a study of Stokes in 2000 (cited in Raab, Woods, and Abdon, 2003) notes that e-learning is characterized by speed, technological transformation, and mediated human interactions.

Wild, Griggs, and Downing (2002) classify the key elements of effective online education namely, interactivity, repetition and practice, presentation styles, content,

accuracy and timeliness. Tian (2001) classifies six basic components of using the Web for education: teachers possessing the knowledge and being able to teach, students willing to learn, the knowledge itself, the means to evaluate the learning outcomes of the learners, the enabling technology, and the communications between teachers and students during the whole process of the teaching and learning activity.

Another important factor for successful e-learning is student support. There should be some methods either online or face-to-face or both for students to contact whenever they have a question related to their studies. In a recent study on satellite lectures for advanced knowledge, Yamaguchi et al. (2003) suggest that face-to-face communication and systematic local support are crucial for the students to learn effectively. Morse and Leoseng (2003) also suggest that e-learning tools must be sufficient to support, motivate and sustain the self-learning process. A study of Berry in 2000 (cited in Wild, Griggs, and Downing, 2002) indicates that five key elements in implementation of online courses are ready network, content application software and tools, and a learning map to link e-learning goals.

However, Kathawala, Abdou, and Elmuti (2002) specified the criteria in selecting online MBA in general. These are the flexibility to enrol in the program and courses, adequate time to complete the courses, the services and quality offered, the price of courses, the accreditation of institutions, the reputation of the university, and the ability to compensate for the lack of face-to-face experience.

2.7 E-learning Current Issues

Even though many academic institutions have implemented e-learning for several years, some did not have sufficient success even worse some had to close their e-learning programs. It is important to identify and discuss major problems and issues of e-learning. Bassi et al., 1998; Dobbs, 2000a; Downey, 2000; Gladieux, 2000; Hase and Ellis, 2001, (cited in Newton, Hase, and Ellis, 2002) argue that the promises for more flexible access to learning and the rapid adoption of e-learning by governments, educational institutions and industries have not been accompanied by an understanding the factors and processes that contribute to effective implementation of e-learning. Some suggestions to the problems and issues will be discussed in this study. One of the problems is underuse of e-learning. Underuse means that the use of e-learning systems drops off after the period of launch out. Forrester (2000) noted that some e-learning courses suffer from dropout rates as high as 80%. Another issue is interactivity

problem. One of the drawbacks of e-learning is static content with weak interactivity (Forrester, 2000). Much of e-learning today is scrolling text and hyperlink of HTML pages. Some e-learning programs have included PowerPoint slides on the course websites for students to download without interaction between instructors and learners.

A difficulty in learning of students is motivation in their learning. Morse and Leoseng (2003) argue that the real issue in realizing the information society is building a motivation for life-long education for their people and offering relevant skills-based training. Similarly, Brooks, Nolan, and Gallagher (2001) argue that most effective Web-teaching materials require active learning. Therefore, e-learning is successful when the learners are active learners and self-responsible to learn. Contemporary learning concepts rely increasingly on the learners rather than teachers.

Another factor that encourages students to join in e-learning is enjoyment. This underlying idea encourages students to learn when they are having fun and are engaged in developing and participating in the learning processes (Mauleon, 2003). Moreover, the instructors have to respond to questions that learners might have. The immediate and relevant feedback and positive reinforcement are keys to effective learning (Mauleon, 2003). Students may interact with the instructor by using chat rooms or discussion boards as communication tools when they have questions or some comments.

However, one of the issues that most scholars discuss in e-learning is technology. Technology plays an important role in supporting students learning by enabling students to search for information, collect, analyse data, produce reports and communicate with instructors or other students. Using ICT as tools in education does not challenge the traditional classroom learning (Kozma, 2003). ICT supports individual student learning by providing information, asking the student questions, and providing feedback and reinforcement, which depend on what was done to the student in traditional learning. The use of technology involved a wide variety of projects that supported education and enriched the learning environment (Kozma, 2003). The works that students produce mostly are in electronic version such as assignments, term papers, lab reports. Furthermore, to have effective e-learning, the network (Volery and Lord, 2000) set up should allow students to have both synchronous and asynchronous exchange. The quality of interface design is important for online delivery. However, the time for exchange of documents needs to be considered. Wild, Griggs, and Downing (2002) indicate that existing technologies could be leveraged to support e-

learning so the learning of new technologies does not interfere with the goals of e-learning.

Based on several e-learning studies, many researchers argue that an extensive exploration should not be overlooked in an assessment of student attitude towards information and communication technology before implementing an e-learning program. One of the models that are widely used to examine the acceptance of users towards technology is Technology Acceptance Model (TAM).

In this study, TAM is used as the baseline model to investigate the attitude of university students toward e-learning and how they accept the existing e-learning system. It is important to understand the reason why TAM model has been used widely in the areas of information technology and information systems, particularly in users' acceptance of information technology and information systems.

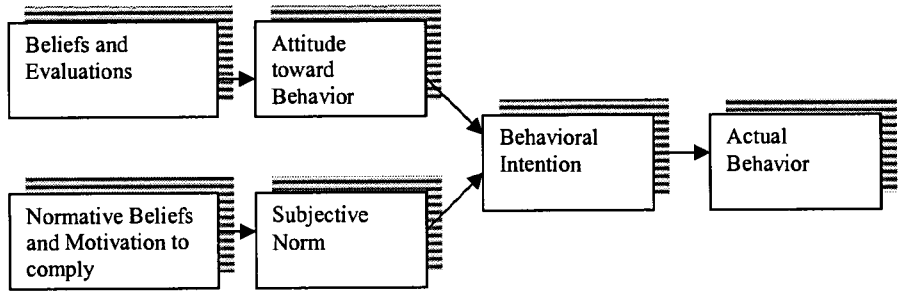
2.8 Technology Acceptance Model (TAM)

E-learning represents a learning system that uses ICT to facilitate and enhance learning. A number of studies have provided some theoretical frameworks for research in the acceptance of information technology (IT) and information system (IS). Two theories that are widely used for measuring technology acceptance are Technology Acceptance Model (TAM) and Theory of Reasoned Action (TRA). However, TAM originally adapted from TRA which is a model concerned with determinants of intention to behaviors (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975). Therefore, it is a need to describe TRA model and how it related to TAM.

TRA model proposed that beliefs influence attitudes associated with subjective norm lead to behavioral intentions and actual behavior. Several studies of user acceptance have borrowed from behavioral intention models in social psychology to develop a theoretical foundation for research on the determinants of user acceptance of IT (Davis, 1989, 1993; Davis, bagozzi, and Warshaw, 1989; Liaw & Huang, 2003; Yi & Hwang, 2003). Furthermore, a study of Jackson, Chow, and Leitch in 1997 argues that one strategy for developing a theoretical base for understanding the constructs and processes involved in a user's acceptance or rejection of information technologies is to focus attention on user attitudes. With TRA model, the study demonstrates that the relationship between cognitions of behavior and the creation of attitudes is important to predict individual behavior (see Figure 2.4). The key factor of the study is the

understanding user attitude from their beliefs and predicting of behavior. However, the study mentions that intentions are determined by individual's attitude and subjective norm concerning the behavior.

Figure 2.4: Theory of Reasoned Action (TRA) Model



Source: Adapted from Davis, Bagozzi and Warshaw (1989)

According to TRA model, the determinant of an individual's behavior is his or her intention to perform the behavior. With TRA model, Davis, bagozzi, and Warshaw (1989) defined "Beliefs" as the individual's belief about object on attribute and "Evaluations" as the individual's evaluation about object on attitude. Attitude toward behavior which is an individual's positive or negative feeling about performing the target behavior is determined by these beliefs and evaluations variables. In addition, an individual's subjective norm is determined by a multiplicative function of his or her "Normative Beliefs" which is social normative belief on what consideration or behavior around expect of the individual and "Motivation" which is the individual's motivation to comply with these expectations. The person's behavioral intention is in turn to be determined by his or her attitude towards the behavior and his or her subjective norm concerning the behavior. Therefore, behavioral intention is a function of the individual's attitude and subjective norm.

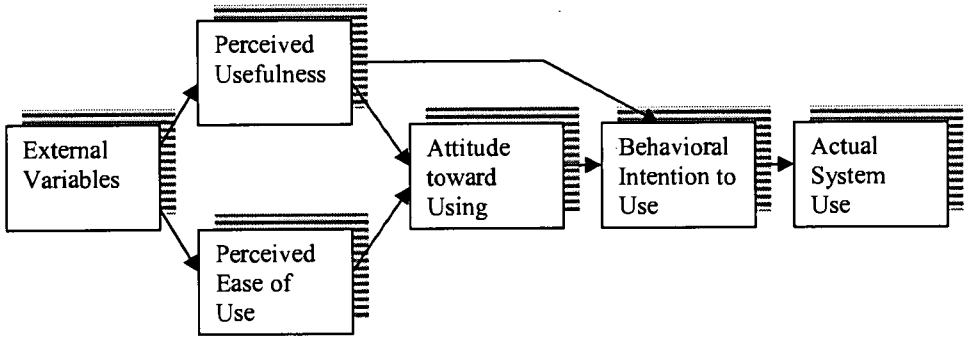
Another model that many IS researchers have used to study individuals' acceptance of technology is Technology Acceptance Model (TAM). Based on several studies, TAM was found to be a strong predictor of intention to use a technology in various organizational and personal situations (Adams et al., 1992; Davis, 1989, 1993; Davis et al., 1989; Igbaria et al., 1995). Similarly, TAM is believed to be most robust, parsimonious, and influential in explaining IT/ IS adoption behavior (Lu et al., 2003).

In the beginning, Davis (1989) had developed TAM which has been adopted widely in understanding users' behavioral and motivational issues in computer and

software adoption and usage. In TAM model, behavioral intention to use information technology was determined by perceived usefulness and perceived ease of use. Both perceived usefulness and perceived ease of use are believed to be important determinants in deciding on acceptance of information technology (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Liaw & Huang, 2003; Yi & Hwang, 2003; Lu et al., 2003). Perceived usefulness is defined as a user's subjective perception of a computer system or software that will enhance his or her work performance. Meanwhile, perceived ease of use refers to the extent in which the user expects a computer system or software to be easy to learn and use (Davis, 1989; Liaw & Huang, 2003; Lu et al., 2003).

According to Figure 2.5, TAM model suggests that both perceived usefulness and perceived ease of use are instrumental in describing the variance in attitude. As Fishbein (1967) defines that attitude is the mediating affective response between beliefs and usage intentions. Similarly, Agarwal and Prasad (1999) attitude is a learned implicit response that refers to an individual's evaluation of a concept.

Figure 2.5: Technology Acceptance Model (TAM)



Source: Adapted from Davis (1989)

In this study, TAM will be used to investigate the acceptance of e-learning system from Thai university students. Davis et al., 1989 (cited in Gahtani, 2001) argues that the objective of using TAM is to provide an explanation of the determinants of computer acceptance which is capable to describe user behavior across a broad range of, end-user computing technologies and user populations. Both perceived usefulness and perceived ease of use will be independent variables that will lead to the attitude toward using e-learning system. With this model, behavioral intention to use e-learning system can be examined. As a study of Fishbein and Ajzen in 1975 (cited in Jackson, Chow,

and Leitch, 1997), behavioral intention was defined as a measure of the strength of individual's intention to perform a specific behavior. Based on several research studies, Adams et al., 1989; Davis, 1989; Davis et al., 1989; Goodwin, 1987; Hill et al., 1987; Igbaria et al., 1997 (cited in Gahtani, 2001) the linkages between two key beliefs which are perceived usefulness and perceived ease of use identify as important factors for user acceptance criteria.

CHAPTER III
RESEARCH FRAMEWORKS

This chapter focuses on the framework of the research. The researcher relates the theories, which are drawn from the literature review to develop the conceptual framework. This chapter consists of three sections, which are theoretical framework, conceptual framework, and research hypothesis.

3.1 Theoretical Framework

Based on the different theoretical framework and studies depicted in the previous chapter, there are many models that influence students' behavioral intention to use e-learning within Thailand university context. The researcher employs Structure Equation Model (SEM) to use in order to develop the proposal model that is referred as the conceptual model. SEM can be used both for variables that are directly observed and for latent variables that cannot be observed directly. It allows the determination of total causal effects. SEM analysis includes a determination of whether the variable variances and co variances computed from the data. The structure model expresses the relationships among independent and dependent variables, even when a dependent variable becomes an independent variable. The proposed relationships are translated into a series of structural equation for each dependent variable. SEM can estimate many equations at once, and they can be an interrelated, meaning that the dependent variable in one equation can be an independent variable in other equation.

In this study, behavioral intention to use is endogenous variable. Perceived benefit and perceived ease of use are exogenous variables. Attitude towards using e-learning system is intervening variable whereas social influences are control variables. In this study, the four items that related to perceived benefit are course contents, collaborative learning, interactivity, and learning outcome along with five items that related to perceived ease of use are computer experience, Internet experience, technical supports, enjoyment, and convenience.

3.2 Conceptual Framework

In order to explore students' attitude toward e-learning system, it is necessary to understand the factors that influence student perceptions toward e-learning system. The

course contents, collaborative learning, interactivity, learning outcome, computer experience, Internet experience, technical supports, enjoyment, and convenience are major factors that affect students' acceptance and use of e-learning system. In the proposed model of predicting the use of e-learning in Thailand, four factors which influence perceived benefit of e-learning program are course contents, collaborative learning, interactivity, and learning outcome. These factors are important and need to be explained as done in the following.

In this study, there are two main sections to measure university students' acceptance from their beliefs which are perceived benefit and perceived ease of use. Both perceived usefulness and perceived ease of use are believed to be important determinants in deciding on acceptance of e-learning systems (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Liaw & Huang, 2003; Yi & Hwang, 2003; Lu et al., 2003). This model is adapted from TAM model as mentioned in the previous section (see Figure 3.1). The first section consists of four variables which are course contents, collaborative learning, interactivity, and learning outcome since these variables have an influence on perceived benefit of e-learning systems. Several studies argue that these variables are required in implementing effective e-learning (Morrison, 2003; Mauleon, 2003; Tian, 2001; Berry, 2000 (cited in Wild, Griggs, and Downing, 2002); Dillon and Gunawardena, 1995; Leidner and Jarvenpaa, 1993 (cited in Volery and Lord, 2000); Schuemer, 1993 (cited in Szeto, 2002); Wild, Griggs, and Downing, 2002).

The other section consists of five variables which are computer experience, Internet experience, technical supports, enjoyment, and convenience because these variables have direct effect on perceived ease of use of e-learning systems. Several studies claim that these variables effect on effective e-learning (Morrison, 2003; Yamaguchi et al., 2003; Mauleon, 2003; Kozma, 2003; Selim, 2002; Evans and Haase, 2001; Stokes, 2000 (cited in Raab, Woods, and Abdon, 2003); University of Texas, 2000 (cited in Evans and Haase, 2001); Dillon and Gunawardena, 1995; Schuemer, 1993 (cited in Szeto, 2002); Leidner and Jarvenpaa, 1993 (cited in Volery and Lord, 2000); Tian, 2001). These variables are crucial factors for the students to learn effectively. They are also important factors to examine how students' perception of benefit and perception ease of use are. It is necessary to describe each variable to rationale why they are required in investigating student acceptance of e-learning.

Course Contents

Students in e-learning course can learn from course contents through some electronic means such as Internet, CD-Rom, and mobile telephone. In this study, the researcher desires to measure course contents through electronic means may cause the problem in e-learning program from the student's perception. Students also can search for an updated information and retrieve the updated course material from the instructor. Therefore, course contents is measured in the study from the student's perception of how important course content through electronic means and retrieving updated course materials from instructor are to e-learning course.

Course contents in this study include what kind of course contents are appropriate in e-learning program. According to a report from IDC (International Data Corporation) in 2000 (cited in Morrison, 2003), IT subject accounted for 72 percent of content demand worldwide. What kind of subject should be in e-learning courses? Should it be basic, advanced, or practical subject? Should it include case studies in the course content? It is easier to develop learning content about hard skills than soft skills. There is a bias against using e-learning for soft contents (Morrison, 2003) because it is more difficult to handle it and to influence learners' behaviors. In order to solve this problem, powerful technology is used to create richer interfaces such as simulations. However, Selim (2002) and Morrison (2003) suggested that course material should be available anytime anywhere so that learners are able to download them.

Collaborative Learning

Salter (2003) states that collaborative learning increases achievement under certain conditions and it tends to increase the ability of students to negotiate and be more tolerant of others. Similarly, collaborative learning may result in improving ability to see the world from another person's point of view, better relations among different ethnic groups in schools and classrooms, increased self-esteem, greater acceptance of handicapped and low-achieving students (Woolfolk, 1995). In this study, collaborative learning includes how much e-learning program helps build learning community. Barreau et al., 1999, (cited in Valenta et al., 2001) reported that students formed good working relationships, felt equality in their contributions, and felt that group enabled them to produce higher quality projects. Moreover, e-learning can

promote group discussion and share the idea among e-learners. In a work of Hiltz, 1998, (cited in Valenta et al., 2001) it was indicated that 55 percent of students felt more motivated to work hard on their assignments because other students would be reading them. Therefore, in this study, collaborative learning is measured from the student's perception of how important learning community, group discussion, and sharing ideas are to e-learning.

Interactivity

Interactivity allows two-way communication. It is a critical factor in both traditional learning and e-learning. Students can have immediate response from lecturer and among the students. Interactivity can also make students more understandable in the subject. They can ask question and get the response real time of different time from the instructor. In case of students who do not have the courage to answer the question in traditional classroom, they may find e-learning course as a benefit to participate and answer the question as the course is not meet face-to-face.

In a research of Valenta et al., (2001) it was noted that students perceived they receive more individual attention from instructors. The expectation of interaction from e-learning system is on the learner's part (Morrison, 2003). If a learner responds poorly, the lecturer knows that the learner might be excluded from the content. Morrison (2003) argues that interactive learning stimulates and motivates the learners to acquire new knowledge and skills. There are many tools that students can use to improve their knowledge and communication skill such as chat room and web board. On the other hand, students can get information quickly from instructors either synchronously or asynchronously. Therefore, in this study, interactivity is measured from the student's perception of how important two-way communication, understanding the subject, enhancing new knowledge, having the courage to ask, and receiving the answer and response are to e-learning.

Learning Outcome

Learning outcome would be one of the most important factors that influence students to enroll in e-learning program. Some students want to learn to gain knowledge for their career and increase their skill, some want to get the degree. Yi and

Hwang (2003) stated that learning goal of students is to understand something new or to enhance their level of competence. In fact, e-learning should enhance student performance and allow students to earn a degree. Every university needs to improve students' performance. Morrison (2003) argues that e-learning needs to be a key part of the university performance improvement strategy. In Koch's study in 1998, (cited in Valenta et al., 2001) it was stated that students in distance education earned higher grades than students in traditional classroom. However, many students expect to have better skills for their career in e-learning course.

Learners also can interact with the lessons and instructors through e-mail, Chat Room, Web Board and also can manage their own learning schedule. Hiltz's study in 1988, 1994 and Wells' study in 1990 (cited in Brooks, Nolan, and Gallagher 2001) indicated that online environments facilitate learning outcomes that are equal or superior to those generated in the face-to-face situation. Similarly, Wu and Hiltz (2004) stated that a combination of face-to-face and computer-mediated discussion provides a superior learning environment compared to the traditional classroom alone. Moreover, investigators at the University of Michigan argue that computer-based instruction provides higher average scores than traditional instruction (Schulman & Sims, 1999). These studies show that using computer and Internet technology for education can improve students' learning performance. In this study, learning outcome is measured from the student's perception of how important career improvement, productivity, and degree earning are to e-learning.

Another determinant that is important in this proposed model is perceived ease of use. Five factors that influence e-learning program are computer experience, Internet experience, technological supports, enjoyment, and convenience. These factors will be discussed in the following pages.

Computer Experience

Computer experience is an important factor for students to study e-learning program. Morrison (2003) stated that learners who need to study e-learning should know how to use computer well enough to take advantage of e-learning. Many researchers such as Dabholkar, 1992, 1996; Dickerson & Gentry, 1983; Korgaonkar & Moschis, 1987, (cited in Lu et al., 2003) and Liaw and Huang (2003) believed that past

experience of using similar technologies contributed greatly to favorable attitudes toward using a new technology and actual adoption. Therefore, it is important to measure the student's perception of how computer skill can help them in e-learning course.

In this study, the researcher has inserted English knowledge into computer experience variable because many courses of e-learning are instructed by using English language. In addition, English is an essential language to search information over the Internet when students need to conduct their research or assignment. Therefore, it is also important to measure the student's perception of how English language can make their e-learning course easier. However, students in e-learning may require high computer skill and knowledge of English language.

Internet Experience

Internet experience is one of the most important factors for e-learning. It is almost impossible for students to learn in e-learning course if they do not know how to use the Internet. Therefore all students who want to study e-learning program have to know how to use Internet since it is mainly used in the program. In a study of Agarwal and Prasad (1999), Internet use experience is believed to be a strong influencing factor on intention to use a specific system through perceived ease of use. Further, students are required to use e-mail as a communication tool to contact instructors and other students. Another important tool that students should know how to use is search engine. It can assist students in finding information needed for their assignments and research. It is important to measure how the student's perception of how the Internet experience can help their study in e-learning course.

Technological Supports

Technological supports are very important factors for e-learning program because Internet technology and other new technologies such as DVD and mobile telephone will be included in the program. Students sometimes need to ask for support while they are studying in e-learning course. There should be someone who can give some advice or suggestions about problems students may have. A study of McKinnon, Nolan, and Sinclair (2000) argues that the students' attitude remains positive and

significantly towards technology more positive than those of students who did not use technology. Students who may use these technologies for their study will need a clear guideline and instruction to use them. Moreover, the speed of the network may be an issue of e-learning.

Students in e-learning course are required to have the Internet connection. If any students do not have Internet connection at their home or their work, they may not enroll in e-learning course. In this study, the researcher intend to measure the student's perception of how important learning guideline and instruction, high speed Internet connection, and some other electronic devices such as CD-Rom and mobile telephone are to e-learning course. Mastrian & McGonigle, 1997, (cited in Valenta et al., 2001) stated that the most negative comment related to the overall experience was the frustration felt by students in the use of computer. If students do not have a good technological support in e-learning course, they may have a negative feeling about e-learning course or they may sense that e-learning course is not easy to learn.

Enjoyment

Enjoyment in this study means the satisfaction felt by students in using computer system (Davis et al., 1992). Teo et al. (1999) found that perceived enjoyment was one of the motivations for the use of the Internet. Students may have fun when they use e-learning system functions such as video-on-demand, real-time chat, etc. It can create a great motivation to learn in e-learning course. Previous studies showed that the effect of enjoyment on ease of use became stronger as users gained more direct experience with the system (Venkatesh, 2000; Venkatesh et al., 2002). One way to raise acceptance levels is to increase user comfort levels with technology in general such as by encouraging students in an academic institution to participate in competitive computer game tournaments.

Enjoyment was found to a factor that influences user acceptance significantly (Wexler, 2001). Similarly, in the studies of Davis et al. (1992) and Venkatesh and Speier (2000), enjoyment is classified as a type of intrinsic motivation of information system users. It is well known that when people are intrinsically motivated, they become productive and effective (Csikszentmihalyi, 1990). Moreover, enjoyment has a significant influence on usefulness via ease of use (Venkatesh, 2000). A recent study of

Yi and Hwang in 2003 showed that enjoyment was one of the sub-dimensions of cognitive absorption with the highest loading score. The system perceived to be easier to use if it is considered to be more enjoyable. Therefore, it is important to measure how the student's perception of enjoyment can make e-learning course much easier.

Convenience

Convenience is another factor that allows learners to participate in e-learning program at any time and anywhere. It is very useful for anyone who wants to learn but is unable to come to a university, especially people who work in cities such as Bangkok in Thailand. Morrison (2003) stated that students are beginning to demand that their learning take place at a time, place, and pace convenient to them. Similarly, Philllips et al. (2000) pointed out advantage of building e-learning that could save both time and money. Learners can learn and communicate directly with instructors and other learners through synchronous learning (Morrison, 2003) which is a real time learning tool such as a virtual class, chat room, or Instant Messaging technologies for peer-to-peer communication.

Learners can also learn when they want to study, answer the questions, and communicate with instructor or other learners any other time by using asynchronous learning tools such as electronic discussion board or Web board, and e-mail to communicate with instructors and other learners. Taking an e-learning program is another option for everyone to increase their knowledge and skills by learning at their convenience in place and time. Therefore, it is important to measure how the student's perception of convenience in particularly place and time while they study an e-learning course.

Attitude towards Using

As mentioned in previous chapter, attitudes are seen as users learned tendencies to evaluate an object for instance e-learning system in a consistently favorable or unfavorable way (Assael, 1995; Mowen and Minor, 1998; Schiffman and Kanuk, 2000). In the same fashion, attitude is defined as an enduring combination of motivational, emotional, perceptual and cognitive processes with respect to some aspect of our environment (Neal, Quester, and Hawkins, 2002).

In this study, students' attitude towards using e-learning systems will be explored before implementing the expensive information technology. Many researchers have adopted TAM model in their studies, however, some have not included attitude towards using variable in their studies. This study also included attitude towards using as mentioned in several studies (Lu et al., 2003; Malhotra and Galletta, 1999; Stoel and Lee, 2003).

Perceived Benefit

Perceived benefit is defined as the extent to which a student believes that using an e-learning system would enhance his or her learning. The terms perceived benefit and perceived usefulness are used interchangeably in this study. Many previous studies have mentioned TAM model which focus on users' perception of usefulness that influences the use of information systems (Davis, 1989; Davis et al., 1992; Venkatesh, 2000; Agarwal and Prasad, 1999; Teo et al., 1999; Yi and Hwang, 2003; and Liaw and Hwang (2003). Phillips et al. (2000) indicates that most of the current evaluation of e-learning program has been driven by users or learners. The studies of Chau (1996) and Jiang et al. (2000) developed utilization of the Internet technology model to explore user acceptance of Internet. The testing the utilization of the Internet technology model confirmed that utilization of the Internet is positively related to perceived benefit.

Perceived Ease of Use

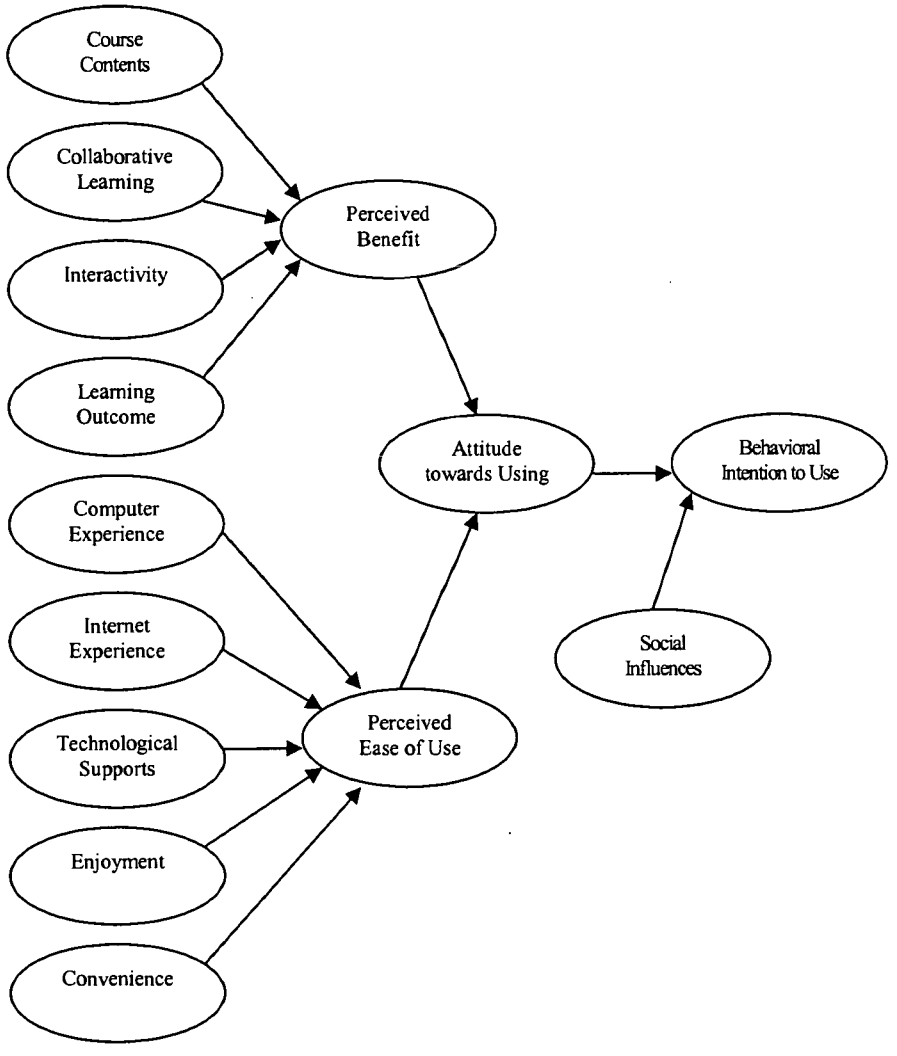
Perceived ease of use is another major determinant of attitude toward the use of e-learning in TAM model. The internal belief ties to an individual's assessment of the mental effort involved in using a system (Davis, 1989). Improvement in perceived ease of use may contribute to improved performance (Lu et al., 2003). However, many studies confirmed the effect of ease of use on attitude toward system use (Al-Gahtani and King, 1999; Lu and Gustafsen, 1994; Moore and Benbasat, 1991; Venkatesh and Davis, 1996). Venkatesh (2000) believed that for any emerging information technology or information system, perceived ease of use is an important determinant of users' intention of acceptance and usage behavior.

Social Influences

Social influences were equivalent to subjective norm and defined as other people's opinion, superior influence, and peer influence (Taylor and Todd, 1995). Similarly, Fishbein and Ajzen (1975) define subjective norm as a person's perception that most people who are important to him or her think he or she should or should not perform the behavior. Moore and Benbasat (1991) pointed out that the use of an innovation is perceived as enhancement of one's status in a social system. However, Davis et al. (1989) believed that in some cases people might use a system to comply with others' mandates rather than their own feelings and beliefs. Prior studies support the relationship between social norms and behavior (Tornatsky and Klein, 1982; Venkatesh and Davis, 2000). In this study, students' peer, parents, and lecturer are social influences that might effect on students' decision making to enroll in e-learning program.

According to a study of Davis et al. in 1989 (cited in Agarwal and Prasad, 1999), the internal psychological variables such as beliefs which are central to TAM fully mediate the effects all other variables in the external environment on an individual's use of an innovation. In this study, a conceptual framework of students' acceptance of e-learning in Thailand is constructed based on TAM model and critical factors for implementing an effective e-learning (see Figure 3.1).

Figure 3.1: Conceptual Framework of Students' Acceptance of E-learning in Thailand



Source: Developed for this study

3.3 Research Hypotheses

Hypotheses are conjectural statement of the relationship between two or more variables that carry clear implications for testing the stated relation (Davis, 1996). In addition, Zikmund (1997) defined hypothesis as a proposition or possible solution to a problem and it is a guess. After identifying the proper variables, the network of association among the variables needs to be elaborated so that relevant hypothesis can be developed and subsequently tested.

There are two types of hypothesis, null hypothesis and alternative hypothesis. The null hypothesis, denoted as Ho always specifies a single value for the population

parameter. Alternative hypothesis, denoted Ha, is the hypothesis that answers question in the study.

After defining the important variables and establishing the relationship among them through the theoretical or conceptual framework, it is now appropriate to test whether the relationship that have been theorized in fact hold true.

1. Perceived Benefit

H1a$_0$: Course content has not significantly influenced on student perceived benefit.

H1a$_1$: Course content has significant influence on student perceived benefit.

H1b$_0$: Collaborative learning has not significantly influenced on student perceived benefit.

H1b$_1$: Collaborative learning has significantly influenced on student perceived benefit.

H1c$_0$: Interactivity has not significantly influenced on student perceived benefit.

H1c$_1$: Interactivity has significantly influenced on student perceived benefit.

H1d$_0$: Learning outcome has not significantly influenced on student perceived benefit.

H1d$_1$: Learning outcome has significantly influenced on student perceived benefit.

2. Perceived Ease of Use

H2a$_0$: Computer experience has not significantly influenced on student perceived ease of use.

H2a$_1$: Computer experience has significantly influenced on student perceived ease of use.

H2b$_0$: Internet experience has not significantly influenced on student perceived ease of use.

H2b$_1$: Internet experience has significantly influenced on student perceived ease of use.

H2c$_0$: Technical support has not significantly influenced on student perceived ease of use.

H2c$_1$: Technical support has significantly influenced on student perceived ease of use.

$H2d_0$: Enjoyment has not significantly influenced on student perceived ease of use.
$H2d_1$: Enjoyment has significantly influenced on student perceived ease of use.

$H2e_0$: Convenience has not significantly influenced on student perceived ease of use.
$H2e_1$: Convenience has significantly influenced on student perceived ease of use.

3. Attitude towards Using E-learning Systems

$H3a_0$: Perceived benefit has not significantly influenced on students' attitude towards using e-learning systems.
$H3a_1$: Perceived benefit has significantly influenced on students' attitude towards using e-learning systems.

$H3b_0$: Perceived ease of use has not significantly influenced on students' attitude towards using e-learning systems.
$H3b_1$: Perceived ease of use has significantly influenced on students' attitude towards using e-learning systems.

4. Behavioral Intention to Use E-learning Systems

$H4_0$: Students' attitude towards e-learning systems has not significantly influenced on behavioral intention to use e-learning systems.
$H4_1$: Students' attitude towards e-learning systems has significantly influenced on behavioral intention to use e-learning systems.

5. Behavioral Intention to Use E-learning Systems

$H5_0$: Social influences have no significantly effect on behavioral intention to use e-learning systems.
$H5_1$: Social influences have significantly effect on behavioral intention to use e-learning systems.

CHAPTER IV
RESEARCH METHODOLOGY

This chapter provides an overview of research methodology that is employed in this study and consists of ten sections. The first section is research methods used. The second is the details of sampling design followed by the third and fourth section, which is sampling process and target population. The fifth section is population element. The sixth section is determining sample size. The seventh section is research instrument and questionnaire, which contains the questions that are asked of the respondents and methods to measure. The eighth section is pilot study that researcher has conducted. The ninth is collection of data and gathering procedures. The final section is the statistical tools used to answer all statement of problems and the criteria used in selecting the appropriate statistics.

4.1 Research Methods Used

The study emphasizes on Thai public university context variables as perceived by students who have participated in e-learning systems.

A specific survey method is used in this study because it is a positivistic methodology whereby a sample of subjects is drawn from a population and studied to make inferences about the population. It provides a basis for generalization, allows replicability, and has statistical power (Hussey and Hussey, 1997). When the total population is small, it is normal to collect data about each member of the population. When the population is large, it would be too time consuming and expensive to collect data about every member and therefore only a sample of the whole population is used (Hussey and Hussey, 1997).

In this study, descriptive and inferential statistics methods are used. Descriptive statistics are used in describing parameters of the students' personal data. The aims of descriptive statistics are to describe the differential of one situation to another and to diagnose the events by using frequency and percentages. Structure Equation Modeling (SEM) is used to determine influence between public university context factors as perceived by university students. SEM represents causal processes that generate observations on multiple variables (Bentler, 1988). After the data is collected from respondents, the data is coded into the symbolic form that is used in Analysis of Moment Structures (AMOS) program for SEM analysis.

4.2 Sampling Design

Sampling is a procedure using a small number of units of a given population as a basis for drawing conclusions about the whole population (Churchill, 1999) since it is impossible to conduct a census to measure characteristics of all elements of a population. Thus the sampling represents the population in the measurement characteristics of the population. There is no accurate list of appropriate individuals from where the target population chosen is available in this research. Thus this research is probability that each element of the population has a fixed probabilistic chance of being selected for the sample (Malholtra, 1999).

4.3 Sampling Process

The sample in this study is students who have participated in e-learning systems in their university in Thailand will be surveyed. Since e-learning system in Thailand is at the initial stage, not many public universities had adopted e-learning systems. There are 24 public universities in Thailand but only 6 of them adopted e-learning systems (The Ministry of University Affairs, 2003). Two public universities which are randomly selected from 6 public universities are as follows:

1. Chulalongkorn University
2. Thammasat University

Next process is distributing the questionnaires to the target group using random sampling. In this study, five faculties will be randomly selected from each university because simple random sampling has the least bias and offers the most generalizability (Sekaran, 2000). From this research, the researcher distributed questionnaires to students who have participated in e-learning systems. Typically, students use e-learning systems to check class assignment, announcements, communicate with instructors and their classmates, and search for information. The students will be asked whether they learned with e-learning system in their class before answering the questionnaire. If they have participated in e-learning, the researcher hands out the questionnaire. The definition of e-learning was included in the survey instrument to improve the validity of the responses. The researcher will be waiting until the students complete the questionnaire. The completed questionnaire will be returned to the researcher after students finish all questions in the questionnaire.

4.4 Target Population

The entire group of people, events or things of interest that the researcher wishes to investigate is called population (Sekaran, 2000) and the target population is the specific complete group relevant to the research project (Zikmund, 1996). The target population for this study comprised of three areas of interest as follows:

1) The target population is both male and female who are in undergraduate or graduate level.

2) The target population should be asked whether they have taken an e-learning course in their universities in Thailand.

3) The time duration that the questionnaires will be distributed to the target population is during September to October 2004.

4.5 Population Element

Population elements for this research are both male and female who are studying in undergraduate or graduate level in their universities. The population who are in higher education institutions is supposed to be mature enough to have their own thinking and can make decision themselves. The questionnaires distribution is performed in the day-time during Monday to Friday when the respondents are available and have time to answer the questionnaires. Moreover, the questionnaires were distributed between September and October 2004, especially after mid-term examination period in order to allow students to evaluate their courses with e-learning systems. Therefore, they can response the questionnaires completely particularly their expecting grade for the subject and the part of learning outcome.

4.6 Determining Sample Size

For this research, the sample size decision should be guided by a consideration of the resource constraints. In this research study, money and time are limited. Other constraints include the availability of qualified personnel for data collection. The sample size required should be adjusted for the incidence of eligible respondents and the completion rate (Malhotra, 1999).

Sampling size is influenced by the average size of sample in similar studies. According to Sekaran (2000), sample size should be not less than 384 respondents for the population size of 1,000,000 persons. To maximize the good representation of the sample, the data will be collected in different faculties at different times.

Table 4.1 provides an idea for sample size decisions. These sample sizes have been determined based on experience and can serve as a guideline (Krejcie and Morgan, 1970 cited in Sekaran, 2000).

Table 4.1 Sample Size for a Given Population Size

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	***1000000***	***384***

Source: Sekaran (2000), Research Methods for Business: A Skill-Building Approach, 3rd edition, New York, John Wiley & Sons, Inc. p.295.

The researcher identifies the sample size based on the reference of population sizes used in research methods for business (Sekaran, 2000) and money and time resources are constraints. Therefore, the sample size of 384 respondents which is supposed to be the minimum and is required size of sample for this study. Sample sizes larger than 30 and less than 500 are appropriate for most research studies (Roscoe, 1975 cited in Sekaran, 2000). Therefore, 420 public university students are sample respondents who participated in this study. All participants volunteered to participate in the study and the sample was random in time. The researcher personally distributed the questionnaires to students and collected them when students finished answering all the

questions. Therefore, a total of 406 are usable responses collected from the respondents representing 96.67% as a response rate.

4.7 Research Instrument/ Questionnaire

The instrument to be used for this research is questionnaire. The closed-end formed questionnaire has been developed from previous literature. Closed-formed questionnaire help respondents to make quick decisions by making a choice among the several alternatives that are provided. This questionnaire is used to get data from target group of respondents. The questionnaire will be prepared in English and Thai versions and distributed to respondents since some respondents are not able to read and understand English fluently.

The questionnaire is composed of two parts as follows:

Part I: Personal Data

This part consists of 12 questions. The respondents will be asked about their personal data such as gender, age, income, work experience, their current faculty, degree they study for, who is responsible for their tuition and fees, expecting grade, and time spent to campus.

Part II: Students' Attitude towards E-learning Systems

This part will ask respondents to express their perception of benefit and their perception of ease of use of e-learning systems in their universities. There are 41 questions with five-points Likert scale asked in this part, where

1=Strongly Disagree

2=Disagree

3=Neutral

4=Agree

5=Strongly Agree

A research of Elmore and Beggs in 1975 (cited in Sekaran, 2000) indicates that a 5-point scale is just as good as any, and an increase from 5 to 7 or 9 points on rating scale does not improve the reliability of the ratings. Therefore, the 5-point Likert scale will be used in this study. The completed questionnaire will be returned to the researcher after students finish all questions in the questionnaire. Nevertheless, in this

study, data was not collected before the introduction of the e-learning system to minimize the possible threats of repeated testing and hypothesis guessing to internal validity (Cook and Campbell, 1979).

4.8 Pilot Study

Pre-testing or pilot study helps a researcher in identifying possible problems that might occur while conducting research. Pretest is a trial method to detect and solve the problem of the questionnaire design. The research pretest is done is order to test reliability of questionnaire by distributing 31 questionnaires to the respondents at the public universities in Thailand. The researcher looks for evidence of ambiguous questions and respondents' misunderstanding and whether the questions mean the same thing to all respondents in terms of wording, meaning of language question transforming, sequence and structure.

The questionnaires have been tested and modified to suit students in higher education level with the reliability alpha value at 94.1%. This concluded that the data collected is at a level that indicated a strong reliability, thus encouraging further statistical relationships to be tested.

4.9 Collection of Data/ Gathering Procedures

In this study, the data will be collected from primary as well as secondary sources as follows:

Primary data:

The primary data is data that is collected through a survey by using the questionnaires that are distributed to sample 420 respondents of Thai public university students by surveying on a face-to-face basis. Before distributing the questionnaires, the respondents will be asked the pre-screening question to indicate that they have participated in e-learning course in their universities. However, the questionnaires are collected during September to October 2004.

Secondary data:

The secondary data is taken from several sources including journals, newspapers, magazines, articles, academic textbooks, libraries as well as via Internet

resources that are related to the topic in order to apply them to the concept of the study to assist in the analysis, recommendation and to draw a conclusion for this study.

4.10 Statistical Treatment of Data

The objective of this research study is to test the students' attitude towards e-learning systems of public university in Thailand. The researcher uses Structure Equation Modeling (SEM) to present causal effect of a set of variables such as course contents, collaborative learning, interactivity, and learning outcome with perceived benefit as well as the effect of a set of variables such as computer experience, Internet experience, technological supports, enjoyment, and convenience with perceived ease of use. After that the relationship between both perceived benefit and perceived ease of use and attitude towards using e-learning systems will be tested, then the relationship between attitude towards using and behavioral intention to use e-learning systems will be investigated. Moreover, social influences are tested to check the effect on behavioral intention to use e-learning systems in this study.

SEM estimates a series of separate, but interdependent, multiple regression equations simultaneously by specifying the structure model used by the statistic program. The data gathered from the respondents were analyzed and summarized in a readable and easily interpretable form after the required data are collected. The questionnaire is processed using SPSS to find out the descriptive statistics used in describing parameters of the respondents' personal data. In addition, SPSS is used to conduct factor analysis. However, the Analysis of Moment Structures (AMOS) utilized to analyze multiple regression according to Bacon (1997) mentioned that it has a unique graphical interface and is specifically designed to make fitting SEM easier.

CHAPTER V
DATA ANALYSIS

This chapter covers the analyses of the collected primary data from 406 questionnaires from the target respondents. The data analysis part can be divided into two main sections. The first section explains the descriptive statistics in the form of frequency table and the second section is the inferential statistical analysis, and the hypothesis testing causal relationship, which is described by structure equation model analysis.

5.1 Descriptive Analysis

This section explains the descriptive statistics which is used to describe information about a population or sample (Zikmund, 1997) in the form of frequency table. The objective of descriptive statistics is to provide summary measures of data contained in all elements of a sample. The measure of central tendency and measures of description are usually concerned (Kinnear, 1991).

The questionnaire is highly creditable because the robustness of the scale was assessed by internal consistency reliabilities as indexed by Cronbach's coefficient alpha, account for 94.1%.

Table 5.1 Personal Data of All Respondents

	Demographic	Frequency	Percentage
Gender	Male	107	26.35
	Female	299	73.65
	Total	**406**	**100.00**
Age	Below 20	359	88.42
	21-30	47	11.58
	Total	**406**	**100.00**
Income	No income	288	70.94
	Less than 20,000	117	28.82
	20,001-25,000	1	0.25
	Total	**406**	**100.00**
Current working status	Work as full time	1	0.25
	Work as part time	24	5.91
	No work	381	93.84
	Total	**406**	**100.00**
Time of work experience	Less than 5	23	5.67
	5 to 10	1	0.25
	Missing value	382	94.09
	Total	**406**	**100.00**

Current enrolments at the university	Bachelor Degree / Full-time	402	99.01
	Master Degree/ Full-time	4	0.99
	Total	**406**	**100.00**

From Table 5.1, females and males comprise 73.65% and 26.35% of the respondents, respectively. Majority of respondents are undergraduate students which accounted for 402 and only 4 graduate students participated in this study. Most of the respondents were below 20 years of age which accounted for 88.42%. Majority of respondents have no income which accounted for 70.94%, only 28.82% of all respondents claimed that they have income less than 20,000 baht. Of all respondents, only 25 students are working while they study, with only 1 student working as full-time. Most participants are from Arts, Business Administration, Social Science, and Software Development majors. Most students have cumulative Grade Point Averages between 2.5 and 3.5, and they account for 67% of the respondents.

Table 5.2 Person Responsible for Respondents' Tuition and Fees

Person	Frequency	Percent
Myself	5	1.23
My parents	383	94.33
My relatives	8	1.97
My institution	4	0.99
Other	6	1.48
Total	**406**	**100.00**

From Table 5.2, majority of respondents is students' parents who responsible for tuition and fees and accounted for 94.33% of all respondents. Only 1.23% of all respondents pay tuition and fees by themselves. Students, whose relatives pay their tuition and fees, account for 1.97% of the respondents. About 1 percent of all respondents pay their tuition and fees by their institution.

Table 5.3 Current Faculty of the Respondents

Faculty	Frequency	Percent
Arts	55	13.55
Business Administration	59	14.53
Social Administration	62	15.27
Sociology and Anthropology	64	15.76
Development Software	73	17.98
Others*	91	22.41
Total	**406**	**100.00**

From Table 5.3, the respondents from faculty of Arts accounted for 13.55% of all respondents while the respondents from faculty of Business Administration accounted for 14.53%. The respondents from faculty of Social Administration accounted for 15.27% of all respondents while the respondents from faculty of Sociology and Anthropology accounted for 15.76%. The respondents from faculty of Development Software accounted for 17.98% of all respondents. Moreover, the other respondents are from other faculties, which are Science, Engineering, Bio Technology, Architecture, Communication Art, Economics, Medicine, and Journalism, accounted for 22.41%.

Table 5.4 Expecting Grade for E-learning Course

Expecting Grade	Frequency	Percent
A	44	10.84
A-	5	1.23
B+	86	21.18
B	151	37.19
B-	21	5.17
C+	57	14.04
C	31	7.64
Below C	11	2.71
Total	**406**	**100.00**

From Table 5.4, majority of respondents is expecting grade B for the course, accounted for 37.19%. The respondents who expect grade B+ for the course, accounted for 21.18% while C+ accounted for 14.04%. Only 10.84% of all respondents expect A for their grade for the course. The respondents who expect grade C for the course, accounted for 7.64% while B- accounted for 5.17%. To my surprise, 2.71% of all the respondents expect their grade below C for the course.

Table 5.5 Average Time Spent from Residence to University

Time spent	Frequency	Percent
Less than 30 minutes	265	65.27
30-60 minutes	80	19.70
1-2 hours	52	12.81
More than 2 hours	9	2.22
Total	406	100.00

From Table 5.5, most respondents spent their time from their residence to university less than 30 minutes which accounted for 65.27%. About 19.70% of all respondents spent 30 to 60 minutes of their time for traveling from their residence to university while the respondents spent their time from 1 hour to 2 hours accounted for 12.81%. Only 2.22% of all respondents spent more than 2 hours from their residence to university.

5.2 Inferential Statistical Analysis

This section is the inferential statistics analysis, the hypothesis testing causal relationship, which is described by structure equation model analysis. The second section of data analysis consists of factor analyses to identify and confirm factors and the assessment of factor reliability. Gorsuch (1983) stated that factor analysis is a statistical technique which reproduces the data by as few factors as possible. The main purpose of conducting factor analysis is to reduce a large number of variables to a smaller number of factors for modeling purposes, where the large number of variables precludes modeling all the measures individually. As such, factor analysis is integrated in structural equation modeling (SEM), helping create the latent variables modeled by SEM. All the scales were factor-analyzed with the iterated principal components method and Varimax rotation using the PC version of SPSS 11.0. Before factor analysis was used, it was checked to satisfy the underlying assumption of sampling adequacy (Norusis, 1986). It is necessary that sample adequacy be tested so that it can be confirmed that the variables within the extracted factors are highly correlated and provide meaningful results.

This research study has started the process of field study from September 2004 to October 2004 which is the period of after mid-term examination. When the data is collected completely, it was entered into SPSS program before transforming the data to be analyzed by AMOS version 5.0. This study uses principal component analysis with Varimax rotation for the proposed construct of students' acceptance of e-learning. Factor analysis will seek to identify one or more underlying dimensions, given a set of variables. Factor analysis combines correlated variables into new variables or factors and reduces the number of variables to a more manageable set. In reducing the number of variables, factor analysis procedures attempt to reduce as much of the information overlap as possible and to make the remaining variables as meaningful and as easy to work with as possible.

Table 5.6: Variables Entered and Removed with Perceived Benefit

Variables Entered/Removed(b)

Model	Variables Entered	Variables Removed	Method
1	LO3, CC5, CC6, IA4, CC1, CC3, CL1, IA5, LO2, CL3, IA1, CC4, IA2, LO1, CL2, IA3, CC2(a)	.	Enter

a All requested variables entered.
b Dependent Variable: PB Perceived Benefit

Table 5.6 shows that all items of independent variables such as Course Contents (CC), Collaborative Learning (CL), Interactivity (IA), and Learning Outcome (LO) are selected to test the appropriateness of data to conduct regression by using Enter method with a dependent variable which is Perceived Benefit.

Table 5.7: Model Summary for Independent Variables and Perceived Benefit

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.552(a)	.305	.274	.64006

a Predictors: (Constant), LO3, CC5, CC6, IA4, CC1, CC3, CL1, IA5, LO2, CL3, IA1, CC4, IA2, LO1, CL2, IA3, CC2

Table 5.7 shows that the values of R Square and Adjusted R Square are quite low Standard Error of the Estimate is quite high. Therefore, this data set is not appropriate for conducting regression.

Table 5.8: ANOVA for Independent Variables and Perceived Benefit

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.680	17	4.099	10.005	.000(a)
	Residual	158.953	388	.410		
	Total	228.633	405			

a Predictors: (Constant), LO3, CC5, CC6, IA4, CC1, CC3, CL1, IA5, LO2, CL3, IA1, CC4, IA2, LO1, CL2, IA3, CC2
b Dependent Variable: PB Perceived Benefit

Table 5.8 illustrates whether independent variables (Course Contents, Collaborative Learning, Interactivity, and Learning Outcome) can be used to predict in this study. The hypothesis will be tested as below:

H_0: All independent variables cannot be used to predict in this study.

H_1: Some independent variables can be used to predict in this study.

The result shows that sig. value is equal to 0.00 which is less than 0.05 therefore H_0 will be rejected. It means that some variables can be used to predict dependent variable in this study.

Table 5.9: Coefficients for Independent Variables and Perceived Benefit

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.859	.256		3.349	.001
	CC1	.123	.058	.123	2.130	.034
	CC2	.006	.057	.007	.111	.912
	CC3	.116	.034	.155	3.407	.001
	CC4	.085	.035	.124	2.460	.014
	CC5	-.032	.034	-.050	-.957	.339
	CC6	.013	.015	.038	.857	.392
	CL1	.110	.044	.126	2.489	.013
	CL2	.054	.049	.062	1.104	.270
	CL3	.076	.051	.076	1.482	.139
	IA1	-.048	.044	-.058	-1.105	.270
	IA2	.016	.047	.019	.341	.733
	IA3	.063	.052	.071	1.221	.223
	IA4	-.021	.036	-.028	-.582	.561
	IA5	.058	.043	.068	1.346	.179
	LO1	.102	.050	.111	2.040	.042
	LO2	.037	.046	.040	.793	.428
	LO3	.125	.040	.143	3.105	.002

a Dependent Variable: PB Perceived Benefit

Table 5.9 shows the sig. value of each independent variable that has effect on perceived benefit. Some of these variables have significantly effect on perceived benefit (sig. < 0.05). However, some do not have significant effect on perceived benefit (sig. > 0.05) since there is multicollinearity problem which there are several scales are designed to measure the same construct in the same study (Gorsuch, 1983). Factor

analysis will be used in this study to reduce the problem of multicollinearity in multiple regressions (Zikmund, 2003).

Table 5.10: Variables Enter and Remove with Perceived Ease of Use

Variables Entered/Removed(b)

Model	Variables Entered	Variables Removed	Method
1	CV2, CE1, TS1, EN1, IE1, TS2, TS3, CE2, CV1, IE3, IE2(a)	.	Enter

a All requested variables entered.
b Dependent Variable: perceived ease of use

Table 5.10 shows that all items of independent variables such as Computer Experience (CV), Internet Experience (IE), Technological Supports (TS), Enjoyment (EN), and Convenience (CV) are selected to test the appropriateness of data to conduct regression by using Enter method with dependent variable which is Perceived Ease of Use.

Table 5.11: Model Summary for Independent Variables and Perceived Ease of Use

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.475(a)	.226	.204	.72306

a Predictors: (Constant), CV2, CE1, TS1, EN1, IE1,TS2, TS3, CE2, CV1, IE3, IE2

Table 5.11 shows that the values of R Square and Adjusted R Square are quite low Standard Error of the Estimate is quite high. Therefore, this data set is not appropriate for conducting regression analysis.

Table 5.12: ANOVA for Independent Variables and Perceived Ease of Use

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	60.138	11	5.467	10.457	.000(a)
	Residual	205.990	394	.523		
	Total	266.128	405			

a Predictors: (Constant), CV2, CE1, TS1, EN1, IE1,TS2, TS3, CE2, CV1, IE3, IE2
b Dependent Variable: perceived ease of use

Figure 5.12 illustrates whether independent variables (Computer Experience, Internet Experience, Technological Supports, Enjoyment, and Convenience) can be used to predict in this study. The hypothesis will be tested as below:

H_0: All independent variables cannot be used to predict in this study.

H_1: Some independent variables can be used to predict in this study.

The result shows that sig. value is equal to 0.00 which is less than 0.05 therefore H_0 will be rejected. It means that some variables can be used to predict dependent variable in this study.

Table 5.13: Coefficients Independent Variables and Perceived Ease of Use

Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.411	.303		4.655	.000
	CE1	-.017	.048	-.019	-.345	.730
	CE2	.062	.053	.067	1.177	.240
	IE1	-.094	.089	-.083	-1.058	.291
	IE2	.093	.089	.086	1.053	.293
	IE3	.084	.076	.075	1.110	.268
	TS1	-.078	.053	-.075	-1.459	.145
	TS2	.011	.053	.012	.208	.835
	TS3	-.009	.055	-.010	-.169	.866
	EN1	.293	.047	.298	6.256	.000
	CV1	.123	.057	.133	2.160	.031
	CV2	.128	.058	.133	2.199	.028

a Dependent Variable: perceived ease of use

Table 5.13 shows the sig. value of each independent variable that influences on perceived benefit. Some of these variables have significant effect on perceived benefit (sig. < 0.05). However, some do not have significant effect on perceived benefit (sig. >

0.05), because there is multicollinearity problem. Factor analysis will be used in this study to reduce the problem of multicollinearity in multiple regressions (Zikmund, 2003).

Therefore, next section of data analysis is the part of factor analysis. The explanation of exploratory factor analysis and correlation matrix and communalities will be discussed. The new variables after conducting factor analysis will be developed.

5.2.1 Exploratory Factor Analysis

Several calculation methods to conduct exploratory factor analysis are available in the widely used general purpose statistical package such as SAS, SPSS or S-Plus. The most commonly employed methods are principal component analysis and principal factor analysis. However, they are based on different mathematical models; they can be used on the same data and produce similar results (SPSS, 1997). In this study, the researcher focuses on principal component analysis which is actually the mainstream method in the application of exploratory factor analysis in a wide range of fields.

SPSS (1997) suggests that there are four main steps in exploratory factor analysis as follows:

1. The correlation or covariance matrix is computed. If a variable has very small correlations with all others, research may consider eliminating it in the next run. Be sure, however, to check the size of its communality and loadings.
2. The factor loadings are estimated. The researcher decides whether the method of factor extraction method is principal component analysis or one of the factor analysis methods of extraction.
3. The loadings are rotated to make the loadings more interpretable. Rotation methods make the loadings for each factor large or small, not in-between.
4. For each case, scores can be computed for each factor and saved for use as input variables in other procedures. Researcher can use saved scores to identify outliers and formulate a strategy for dealing with them.

5.2.2 Analyzing Correlation Matrix and Communalities

Correlation or covariance matrix of variables is developed to examine if there are considerable correlation among variables. The logical assumption underlying factor analysis is that there are one or more latent factors under which the variables show

somewhat similar characteristics and can be classified into a smaller number of groups. Similarity among the variables can be represented by correlations or covariances between them. If there is no variable which has significant correlation with the other variables, it means the factor analysis cannot find the underlying structure which can summarize the relationship among the variables.

From statistical standpoint, the departures from normality, homoscedasticity, and linearity apply only to the extent that they diminish the observed correlations. Only normality is necessary if a statistical test is applied to the significance of the factors, but these tests are rarely used. In fact, some degree of multicollinearity is desirable, because the objective is to identify interrelated set of variables (Hair, et al., 1998).

Principal component analysis explores the linear combination of variables, which account for the maximum amount of variation in the sample. The linear combinations of variables are determined so that the first linear combination accounts for the largest amount of variance among the variables in one dimension, and the second for the next large amount of variances in the other dimension which is uncorrelated with the first one, and so on. Such linear combinations are formulated so as to express each variable as a function of latent factors.

These linear combinations are constructed so as to be uncorrelated to each other. Pearson correlations between the factors loading are always 0. Although it is theoretically possible that the first factor account for 100% of the variances of all the variables, usually there are the same numbers of the factors as variables. Principal component analysis tries to find out the set of factors, which account for as much amount of variances as possible by the first few factors. The sums of squares of each factor loadings are eigenvalues which represent the variance of each factor.

For each variable, communality is calculated, which represent the proportion of the estimated variance explained by common factors. Initial communality is 1 in the case of principal component analysis; this means when the communality for one variable is 1, its variance is perfectly explained by the factors common to the other variables. On the contrary, if the communality of one variable is 0, that variable shares no common factor with the other variables.

It is quite likely that factor analysis procedure derives many factors, often as many as the number of variables. However, even in such a case, the first few factors tend to account for a large part of total variances. The researcher has to extract the set of only important factors, which can sufficiently summarize the variance of total

sample. Actually there is no clear cut standard for determining the numbers of the factors to extract but the following selection criteria are widely used.

- Eigenvalue: total eigenvalue of 1 is often used as a cut point. Those factors whose eigenvalue is less than 1 are regarded as insignificant and unimportant. But in the case the number of variables is either less than 20 or more than 50, eigenvalue of 1 may not be a good cut point (Hair, et al,. 1998).
- Total variance explained: is the sum of the diagonal elements of the correlation matrix or for principal components, the number of variables (SPSS, 1997). In the cases of marketing or other social science research, the set of factors which accounts for some 60-80% of total variance is considered satisfactory.

If unrotated factor matrix does not provide the sufficiently interpretive information, factor rotation is a very helpful to detect the meaning of the factors. This process is called rotation because, in the multidimensional space where the factor loadings of the variables are plotted, the reference axes of the factors are turned about the origin so that each variable takes the position most close to the reference axis of the factor whose loading is the largest among the factors underlying the variable. In the other words, factor rotation makes larger loadings larger and smaller loadings smaller so that the factor pattern becomes simpler and easier to interpret. Usually researcher can more easily figure out the factors underlying each variable because the minimal numbers of factors show a large loading in terms of the variable concerned.

There are several rotation methods available, such as Quartimax, Varimax, Equimax, Promax, and Orthoblique. Although each and all has the certain pros and cons, Varimax rotation is employed in this study since it is widely used. In the actual research situation, the researcher often finds that some of the variables have only poor loadings for all the factors. In such a case, those factors not strongly related to any factor are considered invalid indicators and may be discarded in the following analysis process. There is a rule of thumb that factor loading of plus or minus 0.3 is minimal level and 0.5 is satisfactorily significant.

Table 5.14: KMO and Bartlett's Test for Course Contents

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.559
Bartlett's Test of Sphericity	Approx. Chi-Square	387.352
	df	15
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.14 shows the value of Kaiser-Meyer-Olkin is equal to 0.559 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.15: Communalities for Course Contents

Communalities

	Initial	Extraction
CC1	1.000	.731
CC2	1.000	.752
CC3	1.000	.344
CC4	1.000	.715
CC5	1.000	.680
CC6	1.000	.160

Extraction Method: Principal Component Analysis.

Table 5.16: Variable Names and Descriptions for Course Contents

Variable Names	Descriptions
CC1	Learners can access course materials through electronic media such as Internet, CD-ROM.
CC2	Learners can get updated information and course materials electronically.
CC3	E-learning is appropriate for basic subjects only.
CC4	E-learning is appropriate for advance subjects only.
CC5	E-learning is appropriate for practical subjects only.
CC6	E-learning should include case studies.

Table 5.15 shows initial and extraction values of all variables in course contents dimension. Communality is the proportion of the variance of that variable that can be explained by the common factors. Communalities are reported before and after the desired number of factors are extracted (SPSS, 1999). In the principal components solution, all initial communalities are equal to 1. There can be as many factors as there are variables (SPSS, 1999). The communality for variable CC6 is very low (0.160), so it has little relation to factors. As recommended by Garson (2004), when an indicator variable has a low communality, the factor model is not working well for that indicator and possibly it should be removed from the model. Therefore, the variable CC6 is not joined with the other variables until the very last step. Thus, variable CC6 is dropped out and run factor analysis again. Table 5.16 shows course contents variables and its descriptions.

Table 5.17: KMO and Bartlett's Test for Course Contents (After Dropping CC6)

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.544
Bartlett's Test of Sphericity	Approx. Chi-Square	371.070
	df	10
	Sig.	.000

Table 5.17 shows the value of Kaiser-Meyer-Olkin is equal to 0.544 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.18: Communalities for Course Contents (After Dropping CC6)

Communalities

	Initial	Extraction
CC1	1.000	.838
CC2	1.000	.816
CC3	1.000	.995
CC4	1.000	.727
CC5	1.000	.750

Extraction Method: Principal Component Analysis.

Table 5.18 shows the initial and extraction values of 5 variables after dropping variable CC6. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis.

Table 5.19: Total Variance Explained for Course Contents

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.844	36.881	36.881	1.674	33.485	33.485
2	1.461	29.227	66.108	1.453	29.063	62.549
3	0.820	16.408	82.516	0.998	19.967	82.516
4	0.543	10.854	93.369			
5	0.332	6.631	100.000			

Extraction Method: Principal Component Analysis.

Table 5.19 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors.

Table 5.20: Rotated Component Matrix for Course Contents

Rotated Component Matrix(a)

	Component		
	1	2	3
CC1	.911		
CC2	.890		
CC5		.863	
CC4		.839	
CC3			.982

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 4 iterations.

Table 5.20 shows factor rotation which is very helpful to detect the meaning of the factors. The process called rotation because in the multidimensional space where the factor loadings of the variables are plotted, the reference axes of the factors are turned about the origin so that each variable takes the position most close to the reference axis of the factor whose loading is the largest among the factors underlying the variable. With this process, researcher can figure out the factors underlying each variable since the results show a large loading of the variable concerned. Table 5.20 shows 3 components after factor analysis.

Table 5.21: New Variable Names for Course Contents after Factor Analysis

Variable Names	Descriptions
Updated Information	Learners can access course materials and get updated information through electronic media such as Internet, CD-ROM and mobile
Basic Subjects	E-learning is appropriate for basic subjects only.
Advanced Subjects	E-learning is appropriate for advance and practical subjects
Case Studies	E-learning should include case studies.

Table 5.21 shows new variables and its descriptions after factor analysis for course contents. The variables were reduced from 6 variables to 4 variables.

Factor Analysis Collaborative Learning

Table 5.22: KMO and Bartlett's Test for Collaborative Learning

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.606
Bartlett's Test of Sphericity	Approx. Chi-Square	197.229
	df	3
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.22 shows the value of Kaiser-Meyer-Olkin is equal to 0.606 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.23: Communalities for Collaborative Learning

Communalities

	Initial	Extraction
CL1	1.000	.951
CL2	1.000	.731
CL3	1.000	.859

Extraction Method: Principal Component Analysis.

Table 5.24: Variable Names and Descriptions for Collaborative Learning

Variable Names	Descriptions
CL1	E-learning helps build learning community.
CL2	E-learning enhances learners in understanding the subject by reading other learners' opinion in group discussion.
CL3	E-learning provides sharing of ideas on subject.

Table 5.23 shows the initial and extraction values of 3 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004)

recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis. Table 5.24 shows the variable names and its descriptions for collaborative learning.

Table 5.25: Total Variance Explained for Collaborative Learning

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.798	59.929	59.929	1.416	47.215	47.215
2	0.743	24.780	84.709	1.125	37.493	84.709
3	0.459	15.291	100.000			

Extraction Method: Principal Component Analysis.

Table 5.25 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.25, it recommends to extract number of factors into 2 components. These two components can explain 84.71% of the phenomenon.

Table 5.26: Rotated Component Matrix for Collaborative Learning

Rotated Component Matrix(a)

	Component	
	1	2
CL3	.926	
CL2	.733	.440
CL1		.964

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 3 iterations.

Table 5.27: New Variable Names for Collaborative Learning after Factor Analysis

Variable Names	Descriptions
Learning Community	E-learning helps build learning community.
Sharing Ideas	E-learning enhances learners in understanding the subject by reading other learners' opinion in group discussion and provides sharing of ideas on subject

Table 5.26 shows that 3 variables are extracted into 2 components by using principal component. As the results after rotation using Varimax, 2 variables are grouped into 1 component and another variable is separated in another component. Table 5.27 shows new variable names after factor analysis for collaborative learning which reduced from three variables to two variables.

Factor Analysis for Interactivity

Table 5.28: KMO and Bartlett's Test for Interactivity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.798
Bartlett's Test of Sphericity	Approx. Chi-Square	459.727
	df	10
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.28 shows the value of Kaiser-Meyer-Olkin is equal to 0.798 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.29: Communalities for Interactivity

Communalities

	Initial	Extraction
IA1	1.000	.665
IA2	1.000	.693
IA3	1.000	.685
IA4	1.000	.976
IA5	1.000	.991

Extraction Method: Principal Component Analysis.

Table 5.29 shows the initial and extraction values of 5 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis.

Table 5.30: Variable Names and Descriptions for Interactivity

Variable Names	Descriptions
IA1	E-learning provides two-way communications between lecturer and learners.
IA2	E-learning enhances learners in understanding the subject by interacting with lecturers.
IA3	E-learning helps me have more knowledge while discussing the subject with other learners.
IA4	E-learning makes me ask questions whenever I have questions.
IA5	Lecturer answers all questions when I have questions.

Table 5.30 shows that there are five variable names and its descriptions for interactivity.

Table 5.31: Total Variance Explained for Interactivity

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.566	51.311	51.311	1.916	38.328	38.328
2	0.775	15.490	66.802	1.057	21.149	59.477
3	0.671	13.417	80.219	1.037	20.742	80.219
4	0.566	11.328	91.547			
5	0.423	8.453	100.000			

Extraction Method: Principal Component Analysis.

Table 5.31 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.31, it recommends to extract number of factors into 3 components. These three components can explain 80.22% of the phenomenon.

Table 5.32: Rotated Component Matrix for Interactivity

Rotated Component Matrix(a)

	Component		
	1	2	3
IA1	.807		
IA2	.774		
IA3	.761		
IA4		.960	
IA5			.956

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 4 iterations.

Table 5.32 shows that 5 variables are extracted into 3 components by using principal component. As the results after rotation using Varimax, 3 variables are grouped into 1 component and other two variables are separated into two components. Table 5.33 shows new variable names after factor analysis for interactivity which reduced from five variables to three variables.

Table 5.33: New Variables and Descriptions for Interactivity after Factor Analysis

Variable Names	Descriptions
Inter-Communication	E-learning provides two-way communications between lecturer and learners, discussing with other learners and enhances learners in understanding by interacting with lecturers
Student Inquiry	E-learning makes me ask questions whenever I have questions.
Lecturer Responses	Lecturer answers all questions when I have questions.

Factor Analysis for Learning Outcome

Table 5.34: KMO and Bartlett's Test for Learning Outcome

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.601
Bartlett's Test of Sphericity	Approx. Chi-Square	120.546
	df	3
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.34 shows the value of Kaiser-Meyer-Olkin is equal to 0.601 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.35: Communalities for Learning Outcome

Communalities

	Initial	Extraction
LO1	1.000	.719
LO2	1.000	.712
LO3	1.000	1.000

Extraction Method: Principal Component Analysis.

Table 5.35 shows the initial and extraction values of 3 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis.

Table 5.36: Variable Names and Descriptions for Learning Outcome

Variable Names	Descriptions
LO1	E-learning provides skills for career.
LO2	E-learning enhances productivity and performance.
LO3	E-learning allows study for a degree.

Table 5.36 shows that there are variable names and its descriptions of learning outcome.

Table 5.37: Total Variance Explained for Learning Outcome

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.633	54.440	54.440	1.421	47.351	47.351
2	0.797	26.577	81.017	1.010	33.666	81.017
3	0.569	18.983	100.000			

Extraction Method: Principal Component Analysis.

Table 5.37 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.37, it recommends to extract number of factors into 2 components. These two components can explain 81.02% of the phenomenon.

Table 5.38: Rotated Component Matrix for Learning Outcome

Rotated Component Matrix(a)

	Component	
	1	2
LO1	.839	
LO2	.833	
LO3		.988

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 3 iterations.

Table 5.38 shows that 3 variables are extracted into 2 components by using principal component. As the results after rotation using Varimax, 2 variables are grouped into 1 component and another variable is separated into another component. Table 5.39 shows new variable names after factor analysis for learning outcome which reduced from three variables to two variables.

Table 5.39: New Variable Names for Learning Outcome after Factor Analysis

Variable Names	Descriptions
Productivity	E-learning provides skills for career and enhances productivity and performance.
Degree Acquired	E-learning allows study for a degree.

Factor Analysis Computer Experience

Table 5.40: KMO and Bartlett's Test for Computer Experience

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	153.860
	df	1
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.40 shows the value of Kaiser-Meyer-Olkin is equal to 0.500 which is acceptable to conduct factor analysis. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.41: Communalities for Computer Experience

Communalities

	Initial	Extraction
CE1	1.000	.782
CE2	1.000	.782

Extraction Method: Principal Component Analysis.

Table 5.42: Variable Names and Descriptions for Computer Experience

Variable Names	Descriptions
CE1	E-learning requires high computer skills.
CE2	E-learning requires good English knowledge.

Table 5.41 shows the initial and extraction values of 2 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis. Table 5.42 shows that there are two variable names and its descriptions for computer experience.

Table 5.43: Total Variance Explained for Computer Experience

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.563	78.153	78.153	1.563	78.153	78.153
2	.437	21.847	100.000			

Extraction Method: Principal Component Analysis.

Table 5.43 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The

ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.43, it recommends to extract number of factors into 1 component. Only one component can explain 78.15% of the phenomenon.

Table 5.44: Component Matrix for Computer Experience

Component Matrix(a)

	Component
	1
CE1	.884
CE2	.884

Extraction Method: Principal Component Analysis.
a 1 components extracted.

Table 5.44 shows the component matrix for computer experience. The result shows that only one component is extracted in this dimension. Therefore, two variables are grouped into one variable. There is no need for rotation in this factor analysis. In this dimension, "computer experience" is used as the new variable name for explaining those two variables which are e-learning requires high computer skill and e-learning requires good English knowledge.

Factor Analysis Internet Experience

Table 5.45: KMO and Bartlett's Test for Internet Experience

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.730
Bartlett's Test of Sphericity	Approx. Chi-Square	725.127
	df	3
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.45 shows the value of Kaiser-Meyer-Olkin is equal to 0.730 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.46: Communalities for Internet Experience

Communalities

	Initial	Extraction
IE1	1.000	.838
IE2	1.000	.859
IE3	1.000	.763

Extraction Method: Principal Component Analysis

Table 5.47: Variable Names and Descriptions for Internet Experience

Variable Names	Descriptions
IE1	E-learners must know how to use Internet.
IE2	E-learners must know how to use e-mail.
IE3	E-learners must know how to use search engine.

Table 5.46 shows the initial and extraction values of 3 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis. Table 5.47 shows that there are three variable names and its descriptions for Internet experience.

Table 5.48: Total Variance Explained for Internet Experience

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.459	81.985	81.985	2.459	81.985	81.985
2	0.345	11.526	93.512			

Extraction Method: Principal Component Analysis.

Table 5.48 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.43, it recommends to extract number of factors into 1 component. Only one component can explain 81.99% of the phenomenon.

Table 5.49: Component Matrix for Internet Experience

Component Matrix(a)

	Component
	1
IE1	.915
IE2	.927
IE3	.873

Extraction Method: Principal Component Analysis.
a 1 components extracted.

Table 5.49 shows the component matrix for Internet experience. The result shows that there is only one component which is extracted in this dimension. Therefore, three variables are grouped into one variable after conducting factor analysis. There is no need for rotation in this factor analysis. In this dimension, "Internet experience" is used as new variable name for explaining those three variables which are that e-learners must know how to use Internet, e-mail, and search engine.

Factor Analysis for Technological Supports

Table 5.50: KMO and Bartlett's Test for Technological Supports

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.662
Bartlett's Test of Sphericity	Approx. Chi-Square	228.259
	df	3
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.50 shows the value of Kaiser-Meyer-Olkin is equal to 0.662 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.51: Communalities for Technological Supports

Communalities

	Initial	Extraction
TS1	1.000	.987
TS2	1.000	.725
TS3	1.000	.811

Extraction Method: Principal Component Analysis.

Table 5.51 shows that the initial and extraction values of 3 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis.

Table 5.52: Variable Names and Descriptions for Technological Supports

Variable Names	Descriptions
TS1	Students must have a very clear guide to study by E-learning.
TS2	E-learning requires high speed network.
TS3	E-learning must use all ICT such as Internet, mobile phone, electronic organizer.

Table 5.52 shows that there are three variable names and its descriptions of technological supports.

Table 5.53: Total Variance Explained for Technological Supports

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.894	63.164	63.164	1.469	48.962	48.962
2	0.628	20.934	84.099	1.054	35.137	84.099
3	0.477	15.901	100.000			

Extraction Method: Principal Component Analysis.

Table 5.53 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.53, it recommends to extract number of factors into 2 components. These two components can explain 84.10% of the phenomenon.

Table 5.54: Rotated Component Matrix for Technological Supports

Rotated Component Matrix(a)

	Component	
	1	2
TS3	.890	
TS2	.789	
TS1		.966

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 3 iterations.

Table 5.54 shows that 3 variables are extracted into 2 components by using principal component. As the results after rotation using Varimax, 2 variables are grouped into 1 component and another variable is separated into another component. Table 5.55 shows new variable names after factor analysis for learning outcome which reduced from three variables to two variables.

Table 5.55: New Variable Names for Technological Supports after Factor Analysis

Variable Names	Descriptions
Learning Guide	Students must have a very clear guide to study by E-learning.
Technology Requirements	E-learning requires high speed network and must use all ICT such as Internet, mobile phone, electronic organizer.

For enjoyment variable, there is only one question in the questionnaire. Therefore there is no need to conduct factor analysis.

Factor Analysis for Convenience

Table 5.56: KMO and Bartlett's Test for Convenience

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	225.998
	df	1
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.56 shows the value of Kaiser-Meyer-Olkin is equal to 0.500 which is acceptable to conduct factor analysis. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.57: Communalities for Convenience

Communalities

	Initial	Extraction
CV1	1.000	.827
CV2	1.000	.827

Extraction Method: Principal Component Analysis.

Table 5.57 shows that the initial and extraction values of 2 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will

be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis. Table 5.58 shows that there are two variable names and its descriptions for computer experience.

Table 5.58: Variable Names and Descriptions for Convenience

Variable Names	Descriptions
CV1	Studying by E-learning is convenient anytime.
CV2	Studying by E-learning is convenient anywhere.

Table 5.59: Total Variance Explained for Convenience

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.655	82.743	82.743	1.655	82.743	82.743
2	.345	17.257	100.000			

Extraction Method: Principal Component Analysis.

Table 5.59 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.59, it recommends to extract number of factors into 1 component. Only one component can explain 82.74% of the phenomenon.

Table 5.60: Component Matrix for Convenience

Component Matrix(a)

	Component
	1
CV1	.910
CV2	.910

Extraction Method: Principal Component Analysis.
a 1 components extracted.

Table 5.60 shows the component matrix for convenience. The result shows that there is only one component is extracted in this dimension. Therefore, two variables are grouped into one variable. There is no need for rotation in this factor analysis. In this dimension, convenience is used as new variable name for explaining two variables which are "studying by e-learning is convenient anytime and anywhere".

Factor Analysis for Attitude toward Using E-learning

Table 5.61: KMO and Bartlett's Test for Attitude toward Using E-learning

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.663
Bartlett's Test of Sphericity	Approx. Chi-Square	394.744
	df	10
	Sig.	.000

Kaiser-Meyer-Olkin is used to test the appropriateness of the data set to be used in factor analysis (Vanichbuncha, 2001). Bartlett's Test of Sphericity is used to test hypothesis below:

H_0: There is no relationship among variables.

H_1: There is some relationship among variables.

Table 5.61 shows the value of Kaiser-Meyer-Olkin is equal to 0.663 which is higher than 0.5. The data set is appropriate for using factor analysis. Moreover, the sig. value is 0.000 which is less than 0.05. Reject H_0, this means there is relationship among variables. Therefore, researcher continues the process of factor analysis.

Table 5.62: Communalities for Attitude toward Using E-learning

Communalities

	Initial	Extraction
AT1	1.000	.948
AT2	1.000	.769
AT3	1.000	.786
AT4	1.000	.777
AT5	1.000	.787

Extraction Method: Principal Component Analysis.

Table 5.62 shows that the initial and extraction values of 5 variables. Communalities must be interpreted in relation to the interpretability of the factors. Garson (2004) recommends that a communality of .75 seems high but is meaningless unless the factor on which the variable is loaded is interpretable, though it usually will be. A communality of .25 seems low but may be meaningful if the item is contributing to a well-defined factor. That is, what is critical is not the communality coefficient, but rather the extent to which the item plays a role in the interpretation of the factor, though often this role is greater when communality is high. The result shows that the values of extraction are high and can be used in factor analysis. Table 5.63 shows that there are five variable names and its descriptions for attitude toward using e-learning.

Table 5.63: Variable Names and Description for Attitude toward Using E-learning

Variable Names	Descriptions
AT1	E-learning provides an attractive learning environment.
AT2	E-learning should be acceptable.
AT3	E-learning provides effective learning system.
AT4	Learning costs (tuition + fees) in E-learning should be cheaper than traditional learning.
AT5	E-learning can save traveling cost.

Table 5.64: Total Variance Explained for Attitude toward Using E-learning

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.202	44.041	44.041	1.593	31.851	31.851
2	1.217	24.331	68.372	1.476	29.513	61.364
3	0.649	12.979	81.350	0.999	19.986	81.350
4	0.507	10.136	91.486			
5	0.426	8.514	100.000			
Extraction Method: Principal Component Analysis.						

Table 5.64 shows the values of eigenvalues. The eigenvalue for a given factor measures the variance in all the variables which is accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables (Garson, 2004). If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors. From the table 5.64, it recommends to extract number of

factors into 3 components. These three components can explain 81.35 % of the phenomenon.

Table 5.65: Rotated Component Matrix for Attitude toward Using E-learning

Rotated Component Matrix(a)

	Component		
	1	2	3
AT3	.867		
AT2	.840		
AT5		.853	
AT4		.846	
AT1			.923

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 5 iterations.

Table 5.65 shows that 5 variables are extracted into 3 components by using principal component. As the results after rotation using Varimax, AT2 and AT3 variables are grouped into 1 component, AT4 and AT5 variables are grouped into 1 component, and AT1 variable is separated to another component. Table 5.66 shows new variable names after factor analysis for attitude toward using e-learning which reduced from five variables to three variables.

Table 5.66: New Variable Names for Attitude toward Using E-learning

Variable Names	Descriptions
Attractive Environment	E-learning provides an attractive learning environment.
Effective System	E-learning provides effective learning system and should be acceptable.
Cost Savings	Learning costs (tuition + fees) in E-learning should be cheaper than traditional learning and can save traveling cost

After conducting factor analysis, some variables will be grouped and recalculated by using weighted average. Therefore, the values of new variables will be the values from weighted calculation instead of mean values. An average that takes into account the proportional relevance of each component, rather than treating each component equally. These values are required for the next process which is structural equation modeling (SEM) by using AMOS version 5.0.

5.2.3 Structural Equation Modeling with Latent Variables

Structural equation modeling (SEM) describes relationships between variables in which they are similar to combination of multiple regression which includes various models or methods which explains linear relationship among variables by analyzing correlations or covariances among them (Bacon, 1997). Garson (2004) defines SEM as a hybrid model with both multiple indicators for each variable (called latent variables or factors), and paths specified connecting the latent variables. SEMs provide estimates of the strength of the relationships between variables. Each of the relationships is expressed in the two kinds of equation called structural equation and measurement equation. Measurement model is submodel which measures or describe the relationship (correlation) between variables of interest, which are not directly measurable. In the field of social science, researchers are often interested in constructs that cannot actually be measured at first hand. Such immeasurable variables are called latent variable. Researchers practically have to deal with the indicators of those immeasurable constructs so as to deal measure them. Measurement model specifies the indicators of the construct in question and gauge the reliability of those indicators. Structural model expresses the dependence relationship between the variables including latent variables. The relationship between the constructs is often assumed as causal relationship.

SEM is an extension of the general linear model (GLM) that enables a researcher to test a set of regression equations simultaneously. SEM software can test traditional models, but it also permits examination of more complex relationships and models, such as confirmatory factor analysis and time series analyses (University of Texas at Austin, 2002). One of the most important characteristics of SEMs is that they can analyze the independent relationships of more than one set of variable. For instance, one SEM can encompass several linear regression equations which are not related to each other. Measurement models incorporated in one SEM are in itself a set of relationships among several variables, which describes how the indicators are related to the constructs, and the more than one set of such relationships can be simultaneously analyzed in one model. Therefore, SEM can deal with a very complex relationship between variables, which usually requires several multiple regression equations to be fully described. SEM is very flexibly designed and researchers can easily describe their theoretical or hypothetical models as a SEM. The researchers try to develop more

complex and situation oriented models with which they can confirm their theories or hypotheses. The model can be developed exclusively based on the researcher's insight. SEM is fundamentally employed for verifying such hypothesized models and this is why SEM is mentioned as a confirmatory method rather than exploratory. Moreover, Bacon (1997) mentioned that SEM offer more benefits including an effective way to deal with multicollinearity and methods for taking into account the unreliability of response data.

Although it deals with dependence relationships between variables, SEM is not only a means of prediction. Since SEM expresses the relationship between both latent variables and their indicators in one model, SEM can equip itself with both predictive power and assessment capability of the quality of measurement at the same time. The complicated causal relationships between unobservable latent variables are well described and verified with SEM approach. In addition, SEM can deal with the set of independent variable relationships simultaneously and consequently it does not spoiled by multicollinearity among the variables. Considering the fact that the variables handled in the real social science research situation are often highly correlated, SEM seems to be an effective tool for those who study a complex sociocultural phenomenon.

Bollen and Long (1993) suggests the five stages common to the most applications of SEM as below:

1. Model Specification: the variables and how they are related is determined.
2. Identification: to make sure that the model can specify unique values for the parameters to be estimated.
3. Estimation: parameters express which the relationships between variables are estimated.
4. Testing Fit: the relevance of the model, which is represented by the overall fit of the model to the data, is assessed.
5. Respecification or Model Modification: the model may be modified so as to show a better fit index.

5.2.3.1 Model Specification

SEM is confirmatory procedure and the model to be tested should be originally given. The hypothesized models are often developed on the results of previous study or existing theory. The results of the preliminary data analysis using other procedures, such as exploratory factor analysis may provide useful information to model specification. The model consists of more than one variable and some of them have dependence relationship. What variables to be included to the model, and the way those variables are related must be specified. Figure 5.67 below shows the lists of variable names used throughout the model analysis.

Table 5.67: Observed, endogenous variables

Variable Names	Descriptions
Updated Information	Access course materials and update information electronically
Basic Subjects	Appropriate for basic subjects
Advanced Subjects	Appropriate for advance subjects
Case Studies	Case studies included
Productivity	Productivity and performance
Degree Acquire	Degree obtained
Learning Community	Learning community
Sharing Ideas	Ideas Sharing
Inter-communication	Inter-communication
Students Inquiry	Students inquiry
Lecturer Responses	Lecturer response
Enjoyment	Enjoyment
Internet Experience	Internet experience
Convenience	Convenience
Attractive Environment	Attractive environment
Effective System	Effective learning system
Cost Savings	Cost savings
Intention to enroll	Intention to enroll
Perceived Benefit	Perceived benefit
Perceived Ease of Use	Perceived ease of use
Computer Experience	Computer experience
Learning Guide	Learning guidance
Technology Requirement	Required Technology
Advice from Friends	Seeking advice from friends
Advice from Parents	Seeking advice from parents
Reputation	Reputation of university
Accreditation	Accreditation of university
Advice from Faculty	Seeking advice from faculty

Table 5.68: Unobserved, endogenous variables

Perceived Benefit	
Perceived Ease of Use	
Attitude toward Using	
Behavioral Intention to Use	

Table 5.69: Unobserved, exogenous variables

Course Contents	
ecc1	Error of updated information
ecc2	Error of basic subjects
ecc3	Error of advanced subjects
ecc4	Error of case study
Learning Outcome	
elo1	Error of productivity
elo2	Error of degree acquire
Collaborative Learning	
ecl1	Error of learning community
ecl2	Error of sharing ideas
Interactivity	
eia1	Error of inter-communication
eia2	Error of student inquiry
eia3	Error of lecturer response
een1	Error of enjoyment
eie1	Error of Internet experience
ecv1	Error of convenience
eat1	Error of attractive environment
eat2	Error of effective system
eat3	Error of cost savings
ebi1	Error of intend to enroll
error	Error of behavioral intention to use
epb	Error of useful to learn
eeu	Error of easy to use
ece1	Error of computer experience
Technical Support	
ets1	Error of learning guidance
ets2	Error of technology requirements
ep	Error of perceived benefit
ea	Error of attitude towards using
epe	Error of perceived ease of use
Social Influences	
esi1	Error of friends
esi2	Error of parents
esi3	Error of reputation of university
esi4	Error of accreditation of university
esi5	Error of faculty

Table 5.70: Variable Counts for the Proposed Model

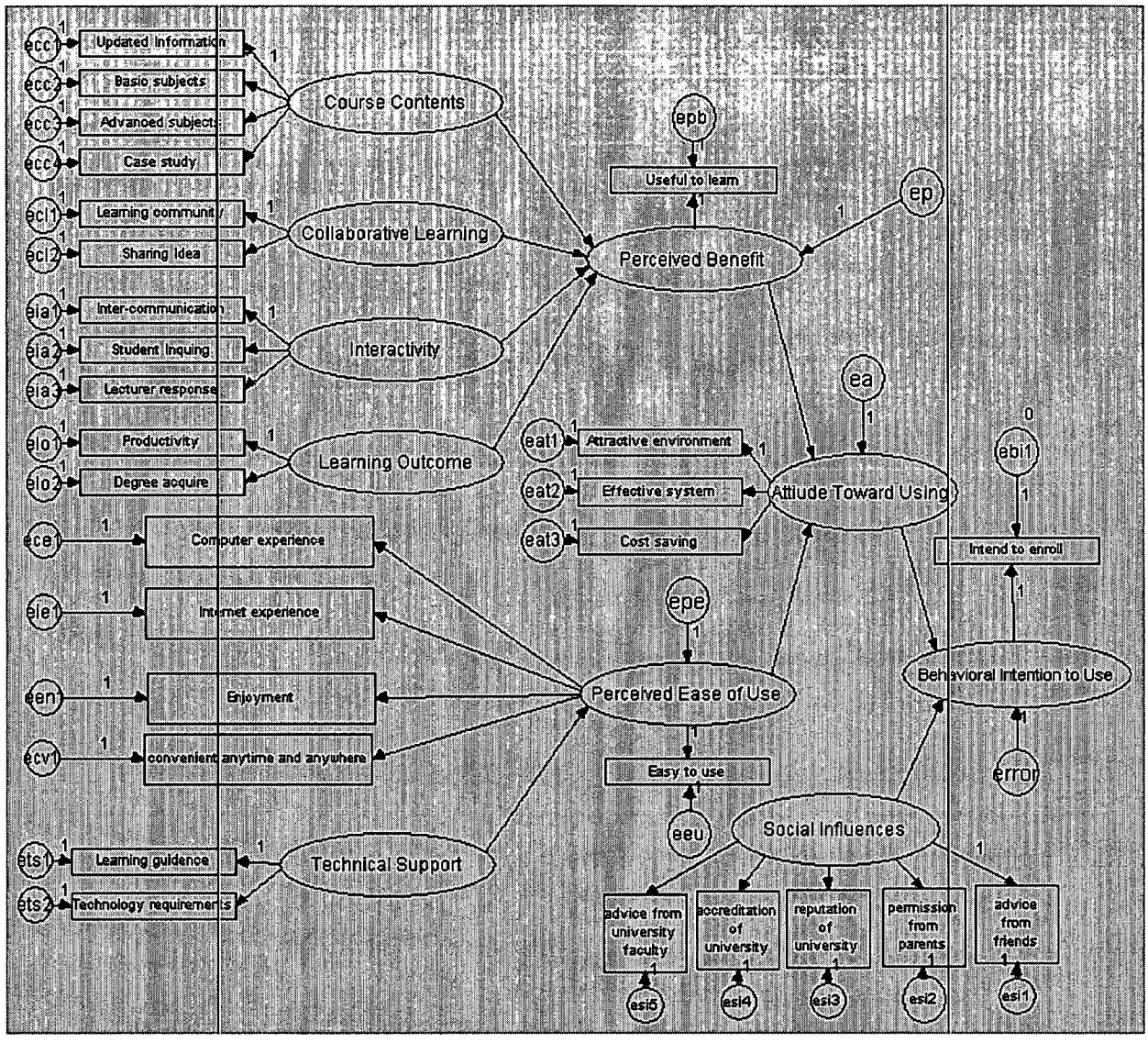
Number of variables in the model:	70
Number of observed variables:	28
Number of unobserved variables:	42
Number of exogenous variables:	38
Number of endogenous variables:	32

Table 5.70 shows the number of variables for the proposed model. Exogenous variables or upstream variables are those variables not influenced by the other variables meanwhile endogenous variables or downstream variables are those variables influenced by at least one other variable in the model (University of Texas at Austin, 2002). If one variable have a dependant relationship on the other variables, it considered as the dependant or out of the other variables, it is regarded as an endogenous variable.

However, it is not likely that the dependent variables are perfectly explained by the independent variables specified in the model. There are many other influencing factors that the model does not take into account. Therefore, error variables are added. Garson (2004) stated that a pure measurement model is a confirmatory factor analysis (CFA) model in which there is unmeasured covariance between each possible pair of latent variables, there are straight arrows from the latent variables to their respective indicators or observed variables, and there are straight arrows from the error and disturbance terms to their respective variables.

Figure 5.1 illustrates the relationship of all variables included independent variables, dependent variable, and latent variables using Structural Equation Modeling with AMOS 5.0. As mentioned in previous part, after factor analysis some variables were grouped and new variables were established. Furthermore, errors were added into both independent and dependent variables. In addition, arrows or relationship were connected from unobserved variables to observed variables.

Figure 5.1: The Proposed Model with AMOS



5.2.3.2 Identification

SEM application always involves the unknown parameters to be estimated through the analysis process. However, SEM involves complex relationships among many variables and does not always generate unique estimates of those unknown parameters (Bollen, 1989). Arbuckle and Wothke (1999) suggested that researcher should find a single-headed arrow leading away from each unobserved variable in the path diagram, and fix the corresponding regression weight to unity. However, if there is more than one single-headed arrow leading away from an unobserved variable, any one of them will usually do, although in some cases, researcher will obtain better parameter estimates when he or she choose the most reliable indicator variable. The model cannot

be identified if there is any unknown parameter that is not specified. This is called a problem of identification. In general, to avoid an identification problem, the model must have more equations than unknown parameters. SEM requires an adequate number of known correlations or covariances as inputs in order to generate a sensible set of results (University of Texas at Austin, 2002). An additional requirement is that each equation be properly *identified.* Identification refers to the idea that there is at least one unique solution for each parameter estimate in a SEM model. Models in which there is only one possible solution for each parameter estimate are said to be *just-identified.* Models for which there are an infinite number of possible parameter estimate values are said to be *underidentified.* Finally, models that have more than one possible solution (but one best or optimal solution) for each parameter estimate are considered *overidentified.* The proposed model in this study is overidentified as the results in positive degrees of freedom. Byrne (2001) stated that the situation results in positive degrees of freedom that allow for rejection of the model, thereby rendering it of scientific use. The aim in SEM is to specify a model such that it meets the criterion of overidentification. Although there are no absolute rule to determine the identification of the model, degree of freedom for the model, as shown below can be a practical criteria (Ichinosawa, 2001).

$$df = \tfrac{1}{2}[(p+q)(p+q+1)]-t$$

where

p = the number of endogenous indicators

q = the number of exogenous indicators

t = the number of estimated coefficient in the proposed model

If the degree of freedom of the model is less than zero, the model is said to be underidentified. The unknown parameters are not given a unique value. An overidentified model has a positive degree of freedom and as degrees of freedom become larger, generalizability of the model to the other data increases. In the case the model's degrees of freedom is just zero, the model is just-identified. A just-identified model perfectly fits to the given data but cannot be applied to the other data.

5.2.3.3 Parameter Estimation

SEM analyzes the correlation or variance-covariance matrix of the variables derived from the raw data to estimate the unknown parameters in the model. Use of correlation matrix is appropriate only the researcher wants to study the relationship between variables because virtually standardized coefficients are generated. If prediction of the actual variances of the dependent variables is in question, variance-covariance matrix should be used. But coefficients estimated should be interpreted in terms of the unit of measurement of each variable. A standardization of the data may remedy this interpretation difficulty. For parameter estimation, SEM computer programs such as AMOS, EQS and LISREL offer several kinds of procedure such as general least squares estimation (GLS), maximum likelihood estimation (ML), asymptotically distribution-free estimation (ADF).

In addition, SEM deal with correlation or variance-covariance matrix as an input data the measurement scale of the raw data should be continuous. However, Kano (1997) suggests that using raw data with discrete variable does not bring a fatal error in most situations, as long as the measurement scale is ordinal (5-point scale or more). Moreover, Chou and Bentler (1990) recommend that the commonly used ML and GLS methods performed quite well in generating reliable statistical results.

5.2.3.4 Testing Overall Goodness-of-fit

In this section, researcher assesses the fit of model to the data. The ultimate goal is to assess the reliability of the model by analyzing how well the model fits to the given data but there is no absolute evaluation criterion in SEM. Bacon (1997) stated that AMOS attempts to fit the model to the data as its goal is to provide the best estimates of the freely varying parameters based on minimizing a function that indexes how well the model fits and subject to the constraints you have defined. Chi-square test is one of the commonly used methods for goodness-of-fit test and can be a fit index in the case of SEM. Kano (1997) suggests that chi-square statistic is appropriate only for middle size samples with several hundred cases.

There are many fit indices that have been supposed however, they are classified into two kinds: absolute and comparative fit. **Goodness-of-fit tests** determine if the

model being tested should be accepted or rejected. If the model is accepted, the researcher will then go on to interpret the path coefficients in the model. The "significant" path coefficients in poor fit models are not meaningful. In AMOS, there are 25 different goodness-of-fit measures that help researcher to evaluate the model's fit. Jaccard and Wan (1996) recommend use of at least three fit tests, one from each of the first three categories like CMIN, RMR and RMSEA, so as to reflect diverse criteria. Kline (1998) recommends at least four tests, such as CMIN; GFI, NFI, or CFI; TLI; and RMR. Another list of which-to-publish lists CMIN, AGFI, TLI, and RMSEA. Although it does not need to report the entire set of fit indexes, only some of them can provide a good sense of how well the model fits the sample data. In order to reflect diverse criteria, the four tests of CMIN, CFI, TLI and RMR are used in the model fit in this study. Because they are believed more suitable to explain the model fit. According to Byrne (2001), the chosen goodness-of-it statistics are used in this study and the goodness-of-fit statistics focuses on indication to consider the model fit in Table 5.71 below.

Table 5.71 Indication to consider the model fit

Fit Indexes	Indication to consider the model fit
CMIN (Minimum Discrepancy)	Model chi-square is the most common fit test printed. CMIN value approximates the degree of freedom indicate fitting hypothesis model. A non-significant chi-square value indicates a good model fit. If model chi-square is less than 0.05, the researcher's model is rejected. Chi-square is sensitive to sample size. In large samples, it may be found to be significant, whereas in small samples it may test as non-significant.
RMR	In well fitting model, RMR value should be small, 0.05 or less. (RMR = Root Mean square Residuals)
GFI and AGFI	Index range from zero to 1.00, with value close to 1.00 being indicative of good fit. (GFI=Goodness-of-Fit Index and AGFI=Adjusted Goodness-of-Fit Index).
RMSEA	If RMSEA value is less than 0.05, it indicates good fit model. If RMSEA value ranges from 0.08 to 0.01, it indicates

	medium fit. If RMSEA value is greater than 0.05, it indicates good model. (RMSEA = Root Mean Square Error)

Table 5.72 shows the model fit indexes to the data of the original proposed model. According to the data, the results of the table 5.72 illustrated that the goodness of fit of the proposed model is not well fit to the model. Arbuckle & Wothke (1999) stated that the model can be modified to improve its fit to the data.

Table 5.72 Goodness of Fit Index and R^2

Fit Indices	Value
R-square (Behavioral Intention to Use)	0.313
Chi-square	1578.939
D.F.	342
RMR	0.121
GFI	0.571
AGFI	0.705
RMSEA	0.095

5.2.3.5 Model Modification

Model modification involves adjusting specified and estimated model by either freeing parameters that formerly were fixed or fixing parameters that formerly were free (Hoyle, 1995). It is widely accepted that a model can be only an approximation at best, and a model can be useful without being true (Jöreskog, 1967). This implies that models are never perfectly correct and can always be rejected on statistical grounds if tested against a big enough sample. Therefore rejection of a model on purely statistical grounds is not necessarily a condemnation. Moderately misfitting models can be modified throughout the research process to improve its fit to the data (Arbuckle & Wothke, 1999). Making the model structure more complex by adding more paths between variables often leads to a better-fit model. However, such modification without any reasonable basis often results in practically meaningless model with no generalizability.

Arbuckle & Wothke (1999) argued that a modification must only be considered if it makes theoretical or common sense. It is recommended that modification index is used for model modification (Arbuckle & Wothke, 1999). AMOS software package can compute modification index for each potential path between variables that can be add to the model. Generally speaking, modification index regarding one potential path suggests the amount of the Chi-square statistic to be reduced, if the path is added to the model.

Table 5.73: Improvement of Goodness-of-Fit Indexes in Model Modification

	CMIN	DF	RMR	GFI	AGFI	RMSEA
Original Proposed Model	1578.939	342	0.121	0.751	0.705	0.095
After Dropping off Social Influences	1274.390	223	0.121	0.758	0.700	0.108
Collaborative Learning and Interactivity	1144.558	222	0.116	0.791	0.740	0.101
Course Contents and Learning Outcome	1088.171	221	0.111	0.809	0.762	0.098
Interactivity and Productivity	1026.083	220	0.108	0.818	0.772	0.095

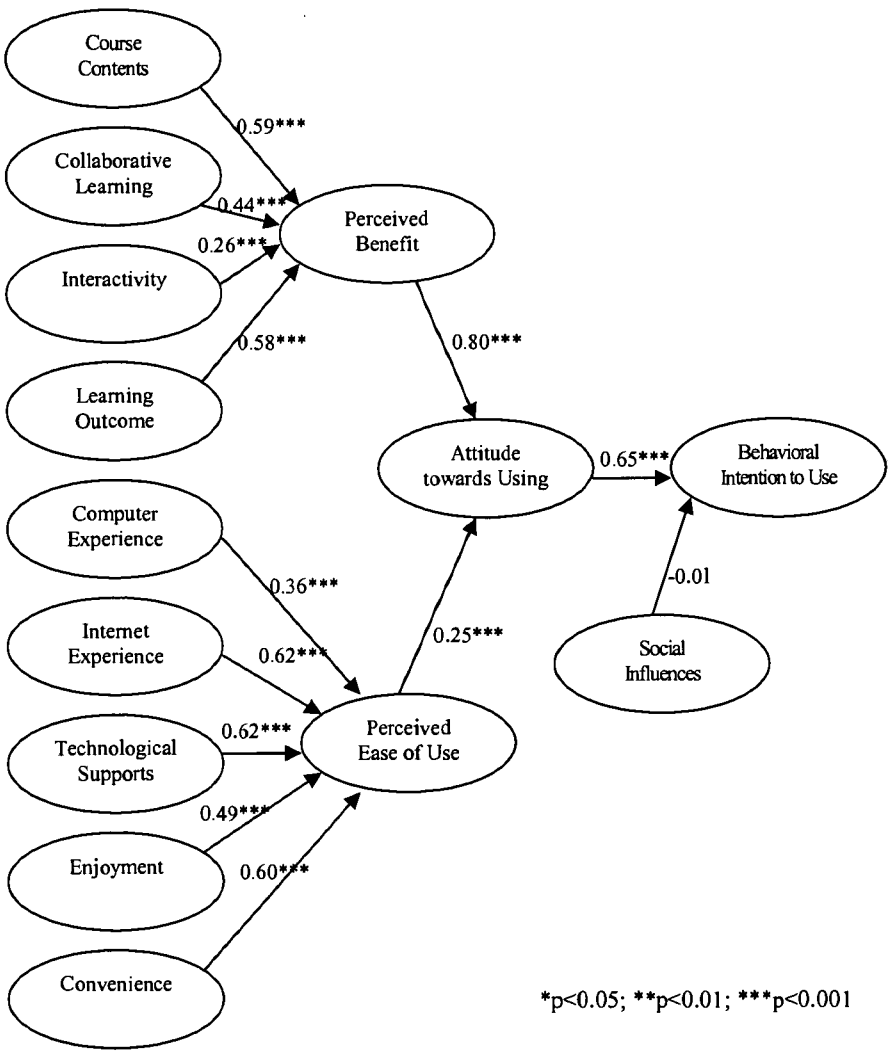
The researcher will propose the analysis results as included with two parts which are the proposed model. Table 5.73 shows improvement of the model fit to the data using CMIN, RMR, GFI, AGFI, and RMSEA. The modified model shows better fit to the data.

As illustrated below in Figure 5.2, the results of hypothesis testing show that the model in this study supports H1a, course contents had a significant effect on perceived benefit (β=0.59, $p<0.001$). Supporting H1b, collaborative learning had a significant effect on perceived benefit (β=0.44, $p<0.001$). Supporting H1c, interactivity had a significant effect on perceived benefit (β=0.26, $p<0.001$). Supporting H1d, learning outcome had a significant effect on perceived benefit (β=0.58, $p<0.001$). The findings in this study show that all factors such as course contents, collaborative learning, interactivity, and learning outcome have significant effect on perceived benefit.

Furthermore, the findings show that all factors such as computer experience, Internet experience, technological supports, enjoyment, and convenience have significant effect on perceived ease of use. This study shows the results that support H2a, computer experience had a significant effect on perceived ease of use (β=0.36, $p<0.001$). Supporting H2b, Internet experience had a significant effect on perceived

ease of use (β=0.62, p<0.001). Supporting H2c, technological supports had a significant effect on perceived ease of use (β=0.62, p<0.001). Supporting H2d, enjoyment had a significant effect on perceived ease of use (β=0.49, p<0.001). Supporting H2e, convenience had a significant effect on perceived ease of use (β=0.60, p<0.001).

Figure 5.2: Proposed Model of Thai University Students' Acceptance of E-learning



The results show a strong relationship between perceived benefit and attitude towards using (β=0.80, p<0.001) and support H3a. It is also supporting H3b, perceived ease of use had significant effect on attitude towards using (β=0.25, p<0.001). Supporting H4, attitude towards using had significant effect on behavioral intention to use (β=0.25, p<0.001).

However, the results show inconsistency with a hypothesis. Inconsistent with H5, social influences had no significant effect on behavioral intention to use (β= -0.01, $p>0.05$). Social influences will not increase students' behavioral intention to use of e-learning systems. Social influences show negative direct effect on behavioral intention to use and the significant level were not within the conventional $p<0.05$. Therefore, Peer, students' parents, reputation of university, accreditation of university, and lecturer will not have significant effect on the relationship between students' attitude toward e-learning systems and behavioral intention to use e-learning systems.

Table 5.74: Regression Weights of Proposed Model

			Estimate	P
Perceived Benefit	<---	Course Contents	0.593	***
Perceived Benefit	<---	Collaborative Learning	0.444	***
Perceived Benefit	<---	Interactivity	0.26	***
Perceived Benefit	<---	Learning Outcome	0.58	***
Perceived Ease of Use	<---	Computer Experience	0.358	***
Perceived Ease of Use	<---	Internet Experience	0.621	***
Perceived Ease of Use	<---	Technical Supports	0.62	***
Perceived Ease of Use	<---	Enjoyment	0.491	***
Perceived Ease of Use	<---	Convenience	0.595	***
Attitude Toward Using	<---	Perceived Benefit	0.796	***
Attitude Toward Using	<---	Perceived Ease of Use	0.252	***
Behavioral Intention to Use	<---	Social Influences	-0.012	0.835
Behavioral Intention to Use	<---	Attitude Toward Using	0.651	***

From Table 5.74, the coefficient value of each path is shown as the parameter estimation. Parameter estimates should exhibit the correct sign and size, and are consistent with the underlying theory. The path between social influences and behavioral intention to use shows negative estimate value and non-significant with p value of 0.84. This means that social influences in this study have no effect on behavioral intention to use and will be dropped off. In summary, the proposed model test supported all the hypotheses except H5.

Figure 5.3: Revised Model of Thai University Students' Acceptance of E-learning

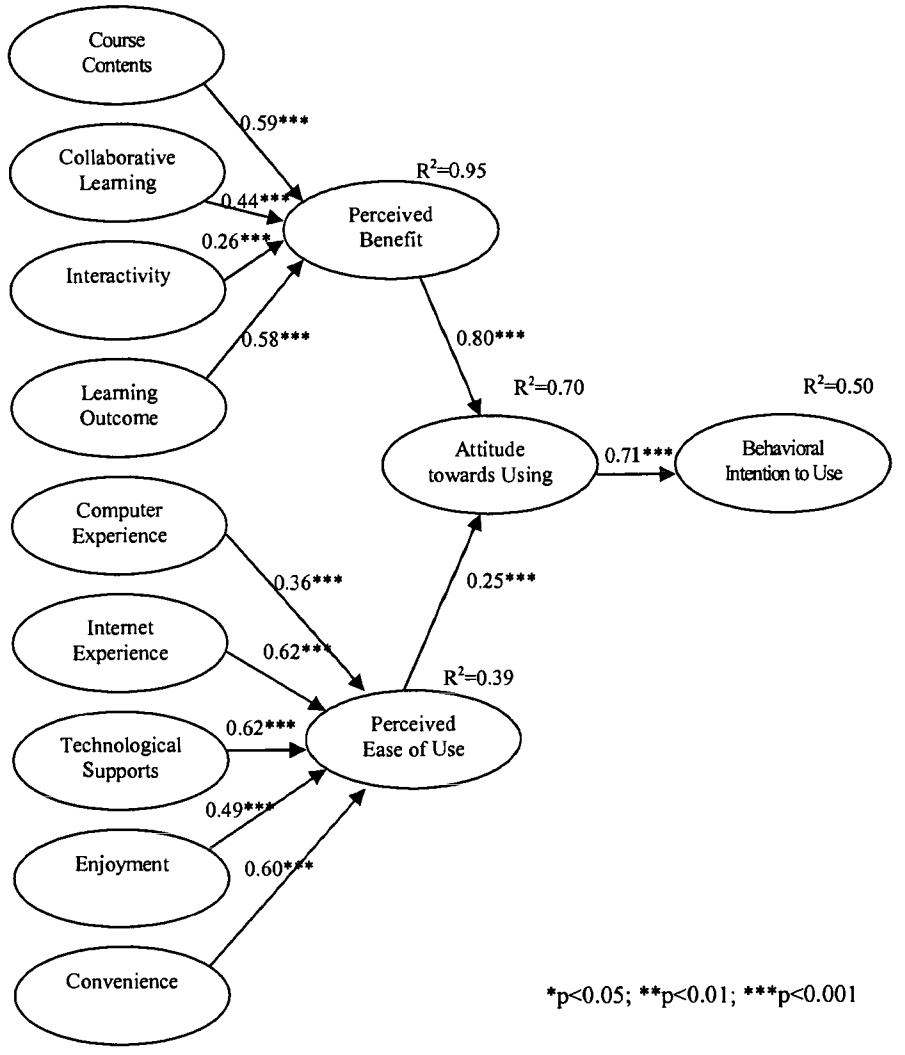


Figure 5.3 shows the results after dropping a determinant which is social influences that is non-significant. The determinants such as course contents, collaborative learning, interactivity, and learning outcome still have significant effect on perceived benefit. In the same way, the determinants of computer experience, Internet experience, technological supports, enjoyment, and convenience still have significant effect on perceived ease of use. In other words, dropping one non-significant variables and re-calculating the model did not disprove or change the significance of the remaining paths.

With the revised model, it also explained variance in perceived benefit (R^2=0.95). Figure 5.3 illustrated that 95% can be explained from course contents, collaborative learning, interactivity and learning outcome variables. In explaining

variance in perceived ease of use (R^2=0.39), only 39% can be explained from computer experience, Internet experience, technological supports, enjoyment, and convenience variables. Moreover, for the attitude towards using variable, 70% can be explained from perceived benefit and perceived ease of use variables (R^2=0.70). The results confirm that perceived benefit and perceived ease of use are two important determinants to explain students' attitude toward using e-learning systems. And for behavioral intention to use, 50% can be explained from attitude toward using variable (R^2=0.50).

The path coefficient values of the structure model are derived from the regression weights that are given in the following table:

Table 5.75 Regression Weights of Revised Model

			Estimate	P
Perceived Benefit	<---	Course Contents	0.593	***
Perceived Benefit	<---	Collaborative Learning	0.444	***
Perceived Benefit	<---	Interactivity	0.26	***
Perceived Benefit	<---	Learning Outcome	0.58	***
Perceived Ease of Use	<---	Computer Experience	0.359	***
Perceived Ease of Use	<---	Internet Experience	0.622	***
Perceived Ease of Use	<---	Technical Supports	0.621	***
Perceived Ease of Use	<---	Enjoyment	0.491	***
Perceived Ease of Use	<---	Convenience	0.595	***
Attitude Toward Using	<---	Perceived Benefit	0.796	***
Attitude Toward Using	<---	Perceived Ease of Use	0.248	***
Behavioral Intention to Use	<---	Attitude Toward Using	0.706	***

From table 5.75, the coefficient value of each path shows the parameter estimation. After one variable and path has been deleted and calculates again, the remaining variables such as course contents, collaborative learning, interactivity, and learning outcome have significant effect on perceived benefit meanwhile computer experience, Internet experience, technological supports, enjoyment, and convenience have significant effect on perceived ease of use. Perceived benefit has a very strong significant effect on attitude towards using while perceived ease of use also has a significant effect on attitude towards using. Moreover, attitude towards using has a strong significant effect on behavioral intention to use.

Table 5.76: Causal Effects of Course Contents, Collaborative Learning, Interactivity, and Learning Outcome for Acceptance of E-learning Model

Effects	Perceived Benefit			Attitude Towards Using			Behavioral Intention to Use		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Course Contents	0.551	0.000	0.551	0.000	0.455	0.455	0.000	0.266	0.266
Updated Information	0.258	0.000	0.258	0.000	0.213	0.213	0.000	0.125	0.125
Basic Subjects	0.242	0.000	0.242	0.000	0.200	0.200	0.000	0.117	0.117
Advanced Subjects	0.127	0.000	0.127	0.000	0.105	0.105	0.000	0.062	0.062
Case Studies	0.145	0.000	0.145	0.000	0.120	0.120	0.000	0.070	0.070
Collaborative Learning	0.419	0.000	0.419	0.000	0.346	0.346	0.000	0.203	0.203
Learning Community	0.215	0.000	0.215	0.000	0.177	0.177	0.000	0.104	0.104
Sharing Ideas	0.325	0.000	0.325	0.000	0.268	0.268	0.000	0.157	0.157
Interactivity	0.1	0.000	0.100	0.000	0.083	0.083	0.000	0.048	0.048
Inter-communication	0.083	0.000	0.083	0.000	0.068	0.068	0.000	0.040	0.040
Student inquiries	0.047	0.000	0.047	0.000	0.039	0.039	0.000	0.023	0.023
Productivity	0.036	0.000	0.036	0.000	0.030	0.030	0.000	0.018	0.018
Lecturer responses	0.054	0.000	0.054	0.000	0.044	0.044	0.000	0.026	0.026
Learning Outcome	0.314	0.000	0.314	0.000	0.259	0.259	0.000	0.152	0.152
Productivity	0.114	0.000	0.114	0.000	0.094	0.094	0.000	0.055	0.055
Degree Acquire	0.187	0.000	0.187	0.000	0.154	0.154	0.000	0.090	0.090

From Table 5.76, standardized direct, indirect, and total effects represented by the model are summarized. This table illustrates the causal effects of course contents, collaborative learning, interactivity, and learning outcome on perceived benefit, attitude toward using e-learning and behavioral intention to use. As the results in Table 5.76 shows course contents are the primary determinant of perceived benefit with a total effect of 0.551 which is entirely a direct effect. Also collaborative learning is another determinant of perceived benefit with the total effect of 0.419 which is the direct effect. Another determinant of perceived benefit to be considered is learning outcome with the total effect of 0.314 and it is the direct effect.

Course contents and collaborative learning are also the determinants of attitude toward using e-learning with the total effects of 0.455 and 0.346 respectively, both are indirect effects. These two determinants will be focused when develop e-learning course for university students.

Table 5.77: Causal Effects of Computer Experience, Internet Experience, Technological Supports, Enjoyment, and Convenience for Acceptance of E-learning Model

Effects	Perceived Ease of Use			Attitude Towards Using			Behavioral Intention to Use		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Computer Experience	0.362	0.000	0.362	0.000	0.079	0.079	0.000	0.046	0.046
Internet Experience	0.626	0.000	0.626	0.000	0.136	0.136	0.000	0.080	0.080
Enjoyment	0.487	0.000	0.487	0.000	0.106	0.106	0.000	0.062	0.062
Convenience	0.591	0.000	0.591	0.000	0.128	0.128	0.000	0.075	0.075
Technological Supports	0.627	0.000	0.627	0.000	0.136	0.136	0.000	0.080	0.080
Learning Guide	0.340	0.000	0.340	0.000	0.074	0.074	0.000	0.043	0.043
Technology Requirements	0.546	0.000	0.546	0.000	0.119	0.119	0.000	0.069	0.069

From Table 5.77, standardized direct, indirect, and total effects represented by the model are summarized. This table illustrates the causal effects of computer experience, Internet experience, technological supports, enjoyment, and convenience on perceived ease of use, attitude toward using e-learning and behavioral intention to use. As the results shown in Table 5.77, technological supports and Internet experience are the main determinants of perceived ease of use with the total effect of 0.627 and 0.626 and they are direct effects. Convenience and enjoyment are next determinants that effect on perceived ease of use with the total effect of 0.591 and 0.487 which are direct effects. Another determinant of perceived ease of use is computer experience with the total effect of 0.362 which is direct effect.

Table 5.78: Causal Effects of Attitude toward Using, Perceived Benefit and Perceived Ease of Use for Acceptance of E-learning Model

Effects	Behavioral Intention to Use		
	Direct	Indirect	Total
Attitude toward Using	0.586	0.000	0.586
Attractive Environment	0.301	0.000	0.301
Effective Learning	0.397	0.000	0.397
Cost Savings	0.234	0.000	0.234
Perceived Benefit	0.000	0.483	0.483
Perceived Ease of Use	0.000	0.127	0.127

From Table 5.78, standardized direct, indirect, and total effects represented by the model are summarized. This table illustrates the causal effects of attitude toward

using, perceived benefit, and perceived ease of use on behavioral intention to use. As the results shown in Table 5.78, attitude toward using is the primary determinant of behavioral intention to use with the total effect of 0.586 which is direct effect. Moreover, two determinants of perceived benefit and perceived ease of use on behavioral intention to use are indirect effects of 0.483 and 0.127 respectively.

As the result of revised model shown in Figure 5.3, it could answer the hypothesis statement, mentioned earlier in chapter three. The researcher could conclude that alternative hypothesis failed to reject when p-value is less than 0.05. The hypotheses of the research study are as follows:

1. Perceived Benefit

$H1a_0$: Course Content has no significant influence on student perceived benefit.

$H1a_1$: Course Content has significant influence on student perceived benefit.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of course contents to perceived benefit had coefficient value at 0.593 with p-value less than 0.05.

Thus, the hypothesis rejects **$H1a_0$**

$H1b_0$: Collaborative learning has no significant influence on student perceived benefit.

$H1b_1$: Collaborative learning has significant influence on student perceived benefit.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of collaborative learning to perceived benefit had coefficient value at 0.444 with p-value less than 0.05.

Thus, the hypothesis rejects **$H1b_0$**

$H1c_0$: Interactivity has no significant influence on student perceived benefit.

$H1c_1$: Interactivity has significant influence on student perceived benefit.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of interactivity to perceived benefit had coefficient value at 0.26 with p-value less than 0.05.

Thus, the hypothesis rejects **$H1c_0$**

$H1d_0$: Learning outcome has no significant influence on student perceived benefit.

$H1d_1$: Learning outcome has significant influence on student perceived benefit.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of learning outcome to perceived benefit had coefficient value at 0.58 with p-value less than 0.05.

Thus, the hypothesis rejects **$H1d_0$**

2. Perceived Ease of Use

$H2a_0$: Computer experience has no significant influence on student perceived ease of use.

$H2a_1$: Computer experience has significant influence on student perceived ease of use.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of computer experience to perceived ease of use had coefficient value at 0.358 with p-value less than 0.05.

Thus, the hypothesis rejects **$H2a_0$**

$H2b_0$: Internet experience has no significant influence on student perceived ease of use.

$H2b_1$: Internet experience has significant influence on student perceived ease of use.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of Internet experience to perceived ease of use had coefficient value at 0.621 with p-value less than 0.05.

Thus, the hypothesis rejects **$H2b_0$**

$H2c_0$: Technological support has no significant influence on student perceived ease of use.

$H2c_1$: Technological support has significant influence on student perceived ease of use.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of technological supports to perceived ease of use had coefficient value at 0.62 with p-value less than 0.05.

Thus, the hypothesis rejects **$H2c_0$**

$H2d_0$: Enjoyment has no significant influence on student perceived ease of use.

$H2d_1$: Enjoyment has significant influence on student perceived ease of use.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of enjoyment to perceived ease of use had coefficient value at 0.491 with p-value less than 0.05.

Thus, the hypothesis rejects **$H2d_0$**

$H2e_0$: Convenience has no significant influence on student perceived ease of use.

$H2e_1$: Convenience has significant influence on student perceived ease of use.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of convenience to perceived ease of use had coefficient value at 0.595 with p-value less than 0.05.

Thus, the hypothesis rejects **$H2e_0$**

3. Attitude towards Using E-learning Systems

$H3a_0$: Perceived benefit has no significant influence the students' attitude towards using e-learning systems.

$H3a_1$: Perceived benefit has significant influence the students' attitude towards using e-learning systems.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of perceived benefit to attitude towards using e-learning systems had coefficient value at 0.796 with p-value less than 0.05.

Thus, the hypothesis rejects **$H3a_0$**

$H3b_0$: Perceived ease of use has no significant influence the students' attitude towards using e-learning systems.

$H3b_1$: Perceived ease of use has significant influence the students' attitude towards using e-learning systems.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of perceived ease of use to attitude towards using e-learning systems had coefficient value at 0.252 with p-value less than 0.05.

Thus, the hypothesis rejects **$H3b_0$**

4. Behavioral Intention to Use E-learning Systems

$H4_0$: Students' attitude towards e-learning systems has not significantly influenced on behavioral intention to use e-learning systems.

$H4_1$: Students' attitude towards e-learning systems has significantly influenced on behavioral intention to use e-learning systems.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of attitude towards using e-learning systems to behavioral intention to use had coefficient value at 0.651 with p-value less than 0.05.

Thus, the hypothesis rejects **$H4_0$**

5. Behavioral Intention to Use E-learning Systems

$H5_0$: Social influences have no significantly effect on behavioral intention to use e-learning systems.

$H5_1$: Social influences have significant effect on behavioral intention to use e-learning systems.

Considering Table 5.74, the result of the data analysis by AMOS revealed that the pathway of social influences to behavioral intention to use had coefficient value at -0.012 with p-value equal to 0.835 which is greater than 0.05.

Thus, the hypothesis fails to reject **$H5_0$**

CHAPTER VI
SUMMARY FINDINGS AND RECOMMENDATIONS

This chapter consists of two parts. The first part shows the summary of the major findings of this research and the summary of hypothesis testing. The second part is the recommendations and suggestions for further research.

6.1 SUMMARY FINDINGS

Descriptive Analysis

From the descriptive statistics analysis part, 406 questionnaires were completely answered by Thai university students. The respondents are females and males comprise 73.65% and 26.35% of the respondents, respectively. Most of them are undergraduate students which accounted for 402 and only 4 graduate students participated in this study.

Majority of the respondents were below 20 years of age which accounted for 88.42% since e-learning system is in the initial stage. Therefore, many e-learning courses started with basic foundation courses which are appropriate for first-year or second-year students.

Most of respondents have no income which accounted for 70.94%, only 28.82% of all respondents claimed that they have income less than 20,000 baht. Of all respondents, only 25 students are working while they study, with only 1 student working as full-time.

Most participants are from Arts (13.55%), Business Administration (14.53%), Social Administration (15.27%), Sociology and Anthropology (15.76%), and Software Development (17.98%) faculties and other faculties from Science, Engineering, Bio Technology, Architecture, Communication Arts, Economics, Medicine, and Journalism (22.41%).

Furthermore, most students have cumulative Grade Point Averages between 2.5 and 3.5, and they account for 67% of the respondents. Majority of respondents is students' parents who responsible for tuition and fees and accounted for 94.33% of all respondents. Only 1.23% of all respondents pay tuition and fees by themselves. Students, whose relatives pay their tuition and fees, account for 1.97% of the

respondents. About 1 percent of all respondents pay their tuition and fees by their institution.

Nevertheless, most respondents spent their time from their residence to university less than 30 minutes which accounted for 65.27%. About 19.70% of all respondents spent 30 to 60 minutes of their time for traveling from their residence to university while the respondents spent their time from 1 hour to 2 hours accounted for 12.81%. Only 2.22% of all respondents spent more than 2 hours from their residence to university.

Inferential Statistical Analysis

From the inferential statistical analysis, the result revealed that the initial proposed model fit quite well with the collected data. However, the researcher proceeded to further model modification in order to get better fit of model to the collected data.

The results shown in Table 5.74 that four pathways indicated all factors such as course contents, collaborative learning, interactivity, and learning outcome have significant effect on perceived benefit. Meanwhile, the findings show that all five factors such as computer experience, Internet experience, technological supports, enjoyment, and convenience have significant effect on perceived ease of use. However, the researcher has not found significant effect between social influences and behavioral intention to use of e-learning systems.

Dropping the pathway that shows non-significant effect from social influences to behavioral intention to use and recalculating can improve the model fit to the collected data. The result of the test of 13 hypotheses, at 95% confidence level, is presented in Table 6.1 shown below.

Table 6.1: Summary of Hypothesis Test Using Structural Equation Modeling with AMOS

Hypotheses	Level of Significant	Correlation Coefficient	Results
$H1a_0$: Course Content has not significantly influenced on student perceived benefit.	0.05	0.593	Reject $H1a_0$
$H1b_0$: Collaborative learning has not significantly influenced on student perceived benefit.	0.05	0.444	Reject $H1b_0$
$H1c_0$: Interactivity has not significantly influenced on student perceived benefit.	0.05	0.26	Reject $H1c_0$
$H1d_0$: Learning outcome has not significantly influenced on student perceived benefit.	0.05	0.58	Reject $H1d_0$
$H2a_0$: Computer experience has not significantly influenced on student perceived ease of use.	0.05	0.358	Reject $H2a_0$
$H2b_0$: Internet experience has not significantly influenced on student perceived ease of use.	0.05	0.621	Reject $H2b_0$
$H2c_0$: Technical support has not significantly influenced on student perceived ease of use.	0.05	0.62	Reject $H2c_0$
$H2d_0$: Enjoyment has not significantly influenced on student perceived ease of use.	0.05	0.491	Reject $H2d_0$
$H2e_0$: Convenience has not significantly influenced on student perceived ease of use.	0.05	0.595	Reject $H2e_0$
$H3a_0$: Perceived benefit has not significantly influenced on students' attitude towards using e-learning systems.	0.05	0.796	Reject $H3a_0$
$H3b_0$: Perceived ease of use has not significantly influenced on students' attitude towards using e-learning systems.	0.05	0.252	Reject $H3b_0$
$H4_0$: Students' attitude towards e-learning systems has not significantly influenced on behavioral intention to use e-learning systems.	0.05	0.651	Reject $H4_0$
$H5_0$: Social influences have no significantly effect on behavioral intention to use e-learning systems.	0.05	-0.012	Accept $H5_0$

From Table 6.1, the hypotheses testing of the Thai university students' acceptance of e-learning model, the result revealed that course contents had a significant effect on perceived benefit with coefficient value at 0.593. Collaborative learning had a significant effect on perceived benefit with coefficient value at 0.444. Interactivity had a significant effect on perceived benefit with coefficient value at 0.26. Learning outcome had a significant effect on perceived benefit with coefficient value at 0.58. Furthermore, computer experience had a significant effect on perceived ease of use with coefficient value at 0.358. Internet experience had a significant effect on perceived ease of use with coefficient value at 0.621. Technological supports had a significant effect

on perceived ease of use with coefficient value at 0.62. Enjoyment had a significant effect on perceived ease of use with coefficient value at 0.491. Convenience had a significant effect on perceived ease of use with coefficient value at 0.595. Moreover, perceived benefit had a significant effect on attitude toward using with coefficient value at 0.796. Perceived ease of use had a significant effect on attitude toward using with coefficient value at 0.252. Attitude toward using had a significant effect on behavioral intention to use with coefficient value at 0.651. Nevertheless, social influences did not reveal any statistically significant effect on behavioral intention to use with a negative coefficient value at -0.012.

As illustrated in Figure 5.3 explained variance in perceived benefit (R^2=0.95) which means 95% can be explained from course contents, collaborative learning, interactivity and learning outcome variables. In explaining variance in perceived ease of use (R^2=0.39) which means 39% can be explained from computer experience, Internet experience, technological supports, enjoyment, and convenience variables. Moreover, for the attitude towards using variable, 70% can be explained from perceived benefit and perceived ease of use variables (R^2=0.70). The results confirm that perceived benefit and perceived ease of use are two important determinants to explain students' attitude toward using e-learning systems. And for behavioral intention to use, 50% can be explained from attitude toward using variable (R^2=0.50).

The results of the study clearly point out the important roles of all determinants (course contents, collaborative learning, interactivity, and learning outcome), which have significant effect on perceived benefit. The results also indicate that other key determinants (computer experience, Internet experience, technological supports, enjoyment, and convenience) which have significant effect on perceived ease of use. These are also the key factors that influence students when they make decision whether to use e-learning systems. The model explains the underlying relationships between these variables and the existing TAM variables which providing insights into how the acceptance and use of e-learning systems can be further explained and facilitated. Twelve out of thirteen hypotheses were supported.

As the results of this study show attitude towards using significantly influenced behavioral intention to use e-learning system (β=0.71, $p<0.001$). Similar findings from

studies of Stoel and Lee (2003); Davis (1989) reported that attitude towards using significantly influenced behavioral intention to use. Perceived benefit significantly influenced attitude towards using (β=0.80, $p<0.001$). Similar findings reported by Stoel and Lee (2003); Davis (1989); and Hu et al. (1999). Perceived ease of use had significant direct effect on attitude towards using (β=0.25, $p<0.001$). Similar findings reported by Stoel and Lee (2003); Davis (1989); Davis et al (1989). Social influences have no significant effect on behavioral intention to use ($p>0.05$). Contrary to the study of Malhotra and Galletta (1999) pointed that social influences play an important role in determining the acceptance of new information technologies.

The findings of this study indicate all four major critical factors for the perceived benefit of e-learning systems. Course content has strong significant effect on perceived benefit (β=0.59, $p<0.001$). Collaborative learning significantly influenced perceived benefit (β=0.44, $p<0.001$). Interactivity significantly influenced perceived benefit (β=0.26, $p<0.001$). Learning outcome significantly influenced perceived benefit (β=0.58, $p<0.001$).

Computer becomes general tools for students to do homework, assignments, and projects. It can be said that computer and Internet are used as a communication tool rather than as a digital storage device or word processing. As the results of this study show students' computer experience significantly influenced perception of ease of use (β=0.36, $p<0.001$). Similar findings from the study of Liaw and Huang (2003) reported that computer experience significantly influenced perceived ease of use (β=0.31, $p<0.01$). In addition, Internet experience significantly influenced perception of ease of use (β=0.62, $p<0.001$). Similar findings from study of Agarwal and Prasad (1999); Stoel and Lee (2003) reported that experience of using Internet technology significantly influenced perceptions of ease of use (β=0.14, $p<0.05$). Technological supports also had significant effect on perceived ease of use (β=0.62, $p<0.001$). Enjoyment had significantly effect on perceived ease of use (β=0.49, $p<0.001$). Similar findings were reported by Liaw & Hwang (2003); Venkatesh (2000). Besides, convenience had a strong significant effect on perceived ease of use (β=0.60, $p<0.001$). This finding is similar to the suggestions of Morrison (2003) and Phillips et al. (2000).

However, this study did not survey students responses at different times. This study is consistent with prior studies on user acceptance of technology (Davis, 1989; Agarwal et al., 1996; Agarwal and Karahanna, 2000) as well as avoids methodological problems associated with the multiple administration of the same instrument (Cook and Campbell, 1979).

The TAM model proposed by Davis et al. (1989) was a successful model to study student acceptance of information technology or information systems. As the results, the significant model paths suggest the general applicability of TAM to university student use of e-learning systems. One important contribution of this study is that it extends the domain of the TAM to student acceptance of e-learning systems.

The study also addressed an important gap in the literature by examining the effect of student experience with e-learning on acceptance of the e-learning over a period of time. Little research has examined student acceptance of e-learning, so the current research provides information to educators that may be helpful in engaging students to use e-learning systems.

6.2 RECOMMENDATIONS

E-learning systems will be an effective learning tool for active learners because it provides students with course materials and other information on the Internet that they can access any time anywhere. They also can interact with instructors and students or other experts to share ideas and information about the courses. Moreover, students can finish assignment and project by using many tools from e-learning and they can get better grade when they study by e-learning systems.

However, acceptance of e-learning from users or students is very important topic for academic institutions. Any institution that wants to implement an e-learning program has to consider about the acceptance from students. Therefore, study about individual students' attitude is necessary before putting a big investment for e-learning systems. Students' attitude can be defined as the way an individual student feels towards a certain object. The result of this study clearly confirmed that attitude toward

using e-learning system was influenced from perceived benefit and perceived ease of use. However perceived benefit has a stronger effect on attitude toward using than perceived ease of use. As Culpan (1995) stated that no matter how sophisticated and capable the technology is, its effective implementation depends on students having a positive attitude towards the e-learning system.

The current study shows that students' attitude towards using e-learning can be predicted from both benefits of e-learning system and ease of use of e-learning system. The findings of this study confirm previous studies that course contents, collaborative learning, interactivity, and learning outcome are the key predictors that predict individual students' perceptions to the benefit of e-learning systems for Thai university. From the findings, academic institution, educator, anyone who intends to implement e-learning systems has to focus on all four factors (course contents, collaborative learning, interactivity, and learning outcome).

The most significant effect on perceived benefit of this study is course content. Students believe that course contents should be available electronically on the Internet or even CD-ROM. Lecturers who teach an e-learning course have to be ready to use technology or e-learning system to post course materials, some files to download, some useful hypertext links and other contents such as animations and multimedia contents for their students to better understand the subject.

Students concern much about their learning outcome. They want to understand subjects that they learn, gain knowledge to develop their skills, and get a degree for their future career. E-learning system can facilitate them to work efficiently on their assignments and projects. They can finish their work faster and can explore other information through the Internet for their work.

Students like to join with the group and share their ideas with others. They can get new ideas from other recommendations and understand other people's ideas from different perspective. Lecturers can establish some topics for students to discuss through Webboard or electronic discussion board.

Furthermore, students really like to interact with lecturer and other students. Lecturer may set a schedule to meet with students twice a week for them to ask questions when they have or keep trace of their learning. Lecturers may need to dedicate their time for students to better understand the subject in e-learning.

The results indicate critical ease of use factors for effective e-learning course which enable students to accomplish their homework, assignments and projects faster by providing them with related hypermedia links and Internet resource. As mentioned earlier currently e-learning is just the beginning stage, the most useful and the easiest tool for students to use is Internet technology since most students already know how to use the Internet from their high school or even secondary school.

However, it is necessary for them to understand how e-learning systems work. Lecturers or educators should set up a training class for students before the e-learning course begins. This is to ensure that students understand how the e-learning systems work and what to do or where to contact when they have problems during their study in e-learning.

Moreover, e-learning course also facilitates students to study their course and understand course materials much easier by having the course material available anytime anywhere, facilitating communication between students and instructors or student to student communication. Moreover, instructors can use interactive tools such as Webboard and chat room to explain course contents and answer students' questions.

In addition, most students like to have enjoyment while studying. Enjoyment which is intrinsic motivation seems to be major determinants of e-learning system use and is a key driver of behavioral intention to use computer. It is critical for understand how to motivate students to learn when implementing an effective e-learning. Lecturers may design an easy to use interface for their e-learning course by adding some online games that are relevant to the subject.

The researcher recommends that further research should focus on how course contents should be designed in an effective e-learning course. How enjoyment can be used in an effective e-learning? How can effective emerging technology foster

inquirers in a knowledge-based society? In addition, this study was conducted with young undergraduate students. Future research may be focusing more on senior students or graduate students who may have more self-discipline for their study and usually they are more likely to be goal-directed learners.

E-learning is a technology that facilitates students to learn effectively and efficiently however, it cannot replace the traditional learning. From an extremely optimistic point of view, e-learning system can provide us highly effective instruction. On the contrary, e-learning will benefit only those who are capable and have accessibility. Students in the distance have to wait for network infrastructure for them to access the Internet technology and e-learning systems. How to ensure that students in e-learning systems have done their assignments, projects and more importantly their examinations and quizzes by themselves?

In addition, to get to the knowledge-based society, the following fundamental questions need to be examined. As mentioned earlier, there is a big investment for e-learning systems. It is not just a lot of computers used by students, servers for the course contents and other materials such as files to download. Moreover, during the semester lecturers need to update and add some course contents, the costs of production and people who work in production are also high. Who will shoulder the costs which exponentially escalate every year?

CHAPTER VII
CONCLUSIONS

The researcher introduces, in chapter one, the importance of information and communication technology (ICT) which is a core technology of e-learning system. Moreover, the number of people who use of the Internet technology is increasing, in contrary the price of computer and other electronic devices are dropping. This creates the opportunity of using ICT for education. In other countries, many universities have implemented e-learning systems. Since there are a lot of benefits of using ICT and e-learning to students, many universities and other academic institutions have started to adopt an e-learning system. It is one of the competitive advantages of the university.

In Thailand, there are many e-learning projects such as SchoolNet for secondary and vocational schools, Inter-University Network (UniNet), Education Network Project (EdNet), Information Technology Campus (IT Campus), and etc. Some are successful in implementing e-learning systems but some have failed. Those universities have already spent a lot of money for their e-learning systems nevertheless some of them finally had to close their e-learning programs. One of the most important factors for success of e-learning systems is the students' acceptance of this new information technology.

The part of related literature review was discussed in chapter 2. E-learning review of literature provides fundamental information of the use of new ICT systems and how university students accept this new technology for their learning. The e-learning system maintains dynamic and evolved notion. Many different types of distance learning had been used interchangeably. To clarify the different meanings of the related terms, the types of distance learning environment such as traditional paper-based, ICT-based, audio and video based, e-learning, online learning, and computer assisted instruction based (CAI) were discussed in this chapter. Moreover, the definition of e-learning used in this study is *a system that is designed to electronically support, facilitate learners who need to have an effective and different kind of interaction with instructors or experts through ICT such as CD-ROM, DVD, or mobile phones as well as to provide learning materials at a convenient and accessible time and place.* Critical success factors related to e-learning and some current issues are

provided in the chapter. The differences between traditional learning and e-learning are discussed. Furthermore, the levels of e-learning implementation are explained.

In this study, the researcher focused on the students' acceptance of e-learning systems. Therefore, the students' attitude toward using of new information technology was explored. This chapter also provided the understanding of three components of attitude (cognitive -> affective -> behavioral) of students which influenced on the actual behavior to use e-learning system.

Moreover, Technology Acceptance Model (TAM) was discussed and adopted in this study as the model to investigate students' attitude toward using e-learning system. As many studies have adopted TAM model to predict the intention to use technology in many fields. In TAM model behavioral intention to use information technology or information systems were determined by perceived benefit and perceived ease of use. Both are believed to be important determinants in deciding on acceptance of information technology.

Chapter 3 provides research framework that related to the theories which are drawn from the literature review to develop conceptual framework and research hypothesis. In this study, behavioral intention to use is dependent variable; perceived benefit and perceived ease of use are independent variables while attitude toward using is intervening variable.

In this study, two main sections to measure university students' acceptance of e-learning are perceived benefit and perceived ease of use. The first section consists of four variables (course contents, collaborative learning, interactivity, and learning outcome) have effect on perceived benefit. The other section consists of five variables (computer experience, Internet experience, technological supports, enjoyment, and convenience) have effect on perceived ease of use.

Chapter 4 discussed about the research methodology used in this study. The first section discussed the research methods used. In this study, the questionnaire survey was used. The next are the details of sampling design and sampling process and target population. Then, the next section is population element and determining sample size. Research instrument and questionnaire that contains the questions that are asked

of the respondents and methods to measure was next stage. The pilot study that researcher has conducted was next. Then, the collection of data and gathering and the final stage is the statistical tools used to answer all statement of problems and the criteria used in selecting the appropriate statistics.

Chapter 5 discussed about data analysis of this study. This chapter covers the analyses of the collected primary data from 406 questionnaires from the target respondents. There are two parts in this study. The first section explains the descriptive statistics in the form of frequency table to provide summary measures of data contained in all elements of a sample. The second section is the inferential statistical analysis, and the hypothesis testing causal relationship, which is described by structure equation model (SEM) analysis using AMOS version 5.0.

In this study, the model of students' acceptance of e-learning system is created by using structural equation modeling (SEM) as an approach to deal with e-learning acceptance and students' attitude toward e-learning program. The critical success factors (course contents, collaborative learning, interactivity, learning outcome, computer experience, Internet experience, technological supports, enjoyment, and convenience) of e-learning are good foundation for both academicians and practitioners interested in implementing an e-learning program.

E-learning is only a mean to achieve higher quality of education. However, student or learner is still a key player to demonstrate its effectiveness. As we know, the Internet technologies have brought exciting features to the education sphere. Chapter 6 discussed about the findings and recommendations of this study. If the university implements an e-learning course that can facilitate and assist the learners to learn by using factors of course contents, collaborative learning, interactivity, and learning outcome, as the result of this study, it is clearly that students will perceive the benefit of the e-learning systems. Moreover, the university should focus on students' perception of ease of use of e-learning systems because if the e-learning system is easy to use, they are more likely to use it. Both perceived benefit and perceived ease of use of e-learning system are the main important determinants to attitude toward using the e-learning systems. From the result of this study, the student behavioral intention to use e-learning system is significantly effected from attitude toward using the e-learning system.

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Appendix A: Questionnaire

(English Version)

E-learning is a learning system that is designed to electronically support, facilitate learners who need to have an effective and different kind of interaction with instructors or experts through ICT such as Internet, CD-ROM, DVD, PDA, or mobile phone as well as to provide learning materials at their convenient and accessible time and place.

Part I: Personal Data

Please circle the numbers representing the most appropriate responses for you in respect of the following items:

1. Have you participated in any E-learning course?

1. Yes
2. No

2. What is your age (years)?

1. Under 21
2. 21-30
3. 31-40
4. 41-50
5. Over 50

3. What is your gender?

1. Male
2. Female

4. What is your income?

1. No income
2. Less than 20,000 baht
3. 20,001 – 25,000 baht
4. 25,001 – 30,000 baht
5. 30,001 – 35,000 baht
6. 35,001 – 40,000 baht
7. More than 40,000 baht

5. Who is responsible for your tuition and fees?

1. Myself
2. My parents
3. My relatives
4. My institution
5. Other (please specify)_____

6. What is your current working status?

1. Work as part time
2. Work as full time
3. I currently don't work (skip to question no. 8)

7. How long is your work experience?

1. Less than 5 years
2. 5 – 10 years
3. 10 – 15 years
4. 15 – 20 years
5. More than 20 years

8. What is your current enrolment at the university?

1. Undergraduate/ Full-time
2. Undergraduate/ Part-time
3. Graduate/ Full-time
4. Graduate/ Part-time
5. Other (please specify)_____

9. What is your current faculty?

1. Arts
2. Business Administration
3. Science and Technology
4. Engineering
5. Bio-Technology
6. Architecture
7. Nursing Science
8. Communication Arts
9. Other (please specify) _____

10. What is your grade point average before taking e-learning course?

1. Less than 2.00
2. 2.00 – 2.50
3. 2.51 – 3.00
4. 3.01 – 3.50
5. More than 3.50

11. What is your expecting grade for e-learning course?

1. A
2. A-
3. B+
4. B
5. B-
6. C+
7. C
8. Below C

12. What is average time spent from your residence to your university?

1. Less than 30 minutes
2. 30-60 minutes
3. 1-2 hours
4. More than 2 hours

Part II: Please circle the numbers representing the most appropriate responses for you in respect of the following statements:

	Scale				
1. Course Content	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.1) Learners can access course materials through electronic media such as Internet, CD-ROM.	1	2	3	4	5
1.2) Learners can get updated information and course materials electronically.	1	2	3	4	5
1.3) E-learning is appropriate for basic subjects only.	1	2	3	4	5
1.4) E-learning is appropriate for advance subjects only.	1	2	3	4	5
1.5) E-learning is appropriate for practical subjects only.	1	2	3	4	5
1.6) E-learning should include case studies.	1	2	3	4	5
2. Collaborative Learning					
2.1) E-learning helps build learning community.	1	2	3	4	5
2.2) E-learning enhances learners in understanding the subject by reading other learners' opinion in group discussion.	1	2	3	4	5
2.3) E-learning provides sharing of ideas on subject.	1	2	3	4	5
3. Interactivity					
3.1) E-learning provides two-way communications between lecturer and learners.	1	2	3	4	5
3.2) E-learning enhances learners in understanding the subject by interacting with lecturers.	1	2	3	4	5
3.3) E-learning helps me have more knowledge while discussing the subject with other learners.	1	2	3	4	5
3.4) E-learning makes me ask questions whenever I have questions.	1	2	3	4	5
3.5) Lecturer answers all questions when I have questions.	1	2	3	4	5
4. Learning Outcome					
4.1) E-learning provides skills for career.	1	2	3	4	5
4.2) E-learning enhances productivity and performance.	1	2	3	4	5
4.3) E-learning allows study for a degree.	1	2	3	4	5
5. Computer Experience					
5.1) E-learning requires high computer skills.	1	2	3	4	5
5.2) E-learning requires good English knowledge.	1	2	3	4	5
6. Internet Experience					
6.1) E-learners must know how to use Internet.	1	2	3	4	5
6.2) E-learners must know how to use e-mail.	1	2	3	4	5
6.3) E-learners must know how to use search engine.	1	2	3	4	5

	Scale				
7. Technical Supports	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
7.1 Students must have a very clear guide to study by E-learning.	1	2	3	4	5
7.2 E-learning requires high speed network.	1	2	3	4	5
7.3 E-learning must use all ICT such as Internet, mobile phone, electronic organizer.	1	2	3	4	5

8. Enjoyment					
8.1) E-learning is enjoyable.	1	2	3	4	5
9. Convenience					
9.1) Studying by E-learning is convenient anytime.	1	2	3	4	5
9.2) Studying by E-learning is convenient anywhere.	1	2	3	4	5
10. Perceived Benefit					
10.1) E-learning is useful to learn.	1	2	3	4	5
11. Perceived Ease of Use					
11.1) E-learning is easy to use.	1	2	3	4	5
12. Attitude toward E-learning					
12.1) E-learning provides an attractive learning environment.	1	2	3	4	5
12.2) E-learning should be acceptable.	1	2	3	4	5
12.3) E-learning provides effective learning system.	1	2	3	4	5
12.4) Learning costs (tuition + fees) in E-learning should be cheaper than traditional learning.	1	2	3	4	5
12.5) E-learning can save traveling cost.	1	2	3	4	5

	Scale				
13. Please indicate the *level of influences* of the following factors if you have a chance to study E-learning in the future:	**Very Low**	**Low**	**Medium**	**High**	**Very High**
13.1) I will seek advice from my friends before enrolling in an E-learning program.	1	2	3	4	5
13.2) I will seek permission from my parents to study by E-learning.	1	2	3	4	5
13.3) I am concerned about reputation of university.	1	2	3	4	5
13.4) I have to check the accreditation (official recognition) of university.	1	2	3	4	5
13.5) I will seek advice from university faculty.	1	2	3	4	5

	Scale				
14. Behavioral Intention to Use E-learning	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
14.1) If I have a chance to study by E-learning, I intend to enroll in E-learning program.	1	2	3	4	5

I sincerely appreciate your time and cooperation. Please check to make sure that you have not skipped any questions.

Appendix B: Questionnaire

(Thai Version)

แบบสอบถาม

การยอมรับระบบการเรียนการสอนแบบอีเลิร์นนิ่งของนักศึกษาในระดับมหาวิทยาลัยของรัฐในประเทศไทย

E-learning หมายถึง การเรียนการสอนทางไกลที่ใช้สื่ออิเลคทรอนิกส์ต่างๆ เช่น อินเตอร์เนต ซีดีรอม หรือ โทรศัพท์มือถือ ซึ่งผู้เรียนและผู้สอนใช้เป็นช่องทางในการติดต่อสื่อสารระหว่างกัน ผู้เรียนสามารถเข้าถึงแหล่งข้อมูลมากมายที่มีอยู่ทั่วไปอย่างไร้ขอบเขตผู้เรียนสามารถทำกิจกรรมหรือแบบฝึกหัดได้โดยใช้อินเตอร์เนตหรือเครื่องมืออิเลคทรอนิกส์อื่นๆอย่างไม่มีข้อจำกัดเรื่องเวลาและสถานที่

ส่วนที่ 1 ข้อมูลส่วนตัว

กรุณาทำเครื่องหมายวงกลมรอบหมายเลขที่เหมาะสมที่สุดกับคำถามต่อไปนี้

1 คุณเคยเข้าร่วมในวิชาที่มีการเรียนการสอนแบบ e-learning หรือไม่

1) เคย
2) ไม่เคย

2 คุณอายุเท่าไร

1) ต่ำกว่า 21
2) 21-30
3) 31-40
4) 41-50
5) มากกว่า 51

3 คุณเพศอะไร

1) ชาย
2) หญิง

4 คุณมีรายได้เท่าไร

1) ไม่มีรายได้
2) ต่ำกว่า 20000 บาท
3) 20001 – 25000 บาท
4) 25001 – 30000 บาท
5) 30001 – 35000 บาท
6) 35001 – 40000 บาท
7) มากกว่า 40000 บาท

5 ใครเป็นผู้รับผิดชอบค่าเล่าเรียนของคุณ

1) ตัวเอง
2) ผู้ปกครอง
3) ญาติ
4) สถาบัน
5) อื่นๆ (โปรดระบุ)_____

6 สถานภาพการทำงานปัจจุบันของคุณคืออะไร

1) ทำงานประจำ
2) ทำงานพิเศษ
3) ไม่ทำงาน (ข้ามไปข้อ 8)

7 คุณมีประสบการณ์ทำงานกี่ปี

1) น้อยกว่า 5 ปี

2) 5 – 10 ปี

3) 10 - 15 ปี

4) 15 - 20 ปี

5) มากกว่า 20 ปี

8 ปัจจุบันคุณลงทะเบียนที่มหาวิทยาลัยแบบใด

1) ปริญญาตรีภาคปกติ

2) ปริญญาตรีภาคพิเศษ

3) ปริญญาโทภาคปกติ

4) ปริญญาโทภาคพิเศษ

5) อื่นๆ (โปรดระบุ)_____

9 ปัจจุบันคุณศึกษาอยู่ในคณะอะไร

1) ศิลปะศาสตร์

2) บริหารธุรกิจ

3) วิทยาศาสตร์และเทคโนโลยี

4) วิศวกรรมศาสตร์

5) เทคโนโลยีชีวภาพ

6) สถาปัตยกรรม

7) พยาบาล

8) นิเทศน์ศาสตร์

9) อื่นๆ (โปรดระบุ)_____

10 เกรดเฉลี่ยของคุณก่อนเรียนวิชาที่มีการเรียนการสอนแบบe-learning อยู่ในระดับใด

1) ต่ำกว่า 2.00

2) 2.00 – 2.50

3) 2.51 – 3.00

4) 3.01 – 3.50

5) มากกว่า 3.50

11 เกรดที่คิดว่าจะได้ในวิชาที่มีการเรียนการสอนแบบ e-learning

1) A

2) A-

3) B+

4) B

5) B-

6) C+

7) C

8) น้อยกว่า C

12 โดยเฉลี่ยคุณใช้เวลาในการเดินทางจากที่พักของคุณถึงมหาวิทยาลัยเท่าไร

1) น้อยกว่า 30 นาที

2) 30-60 นาที

3) 1-2 ชั่วโมง

4) มากกว่า 2 ชั่วโมง

ส่วนที่ 2 ความคิดเห็นเกี่ยวกับระบบการเรียนการสอนแบบ e-learning

กรุณาทำเครื่องหมายวงกลมรอบหมายเลขที่เหมาะสมที่สุดกับประโยคต่อไปนี้

1. เนื้อหาในวิชา (Course Content)	ไม่เห็นด้วยอย่างมาก	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างมาก
1.1) ผู้เรียนสามารถดูเนื้อหาในวิชาผ่านสื่ออิเลคทรอนิกส์ต่างๆ เช่น อินเตอร์เนต ซีดีรอม โทรศัพท์มือถือ	1	2	3	4	5
1.2) ผู้เรียนสามารถได้รับข้อมูลและเนื้อหาในวิชาที่ล่าสุดโดยใช้สื่ออิเลคทรอนิกส์ต่างๆ	1	2	3	4	5
1.3) การเรียนการสอนแบบe-learning เหมาะสำหรับวิชาพื้นฐาน	1	2	3	4	5
1.4) การเรียนการสอนแบบe-learning เหมาะสำหรับวิชาชั้นสูง	1	2	3	4	5
1.5) การเรียนการสอนแบบe-learning เหมาะสำหรับวิชาเชิงปฏิบัติ	1	2	3	4	5
1.6) การเรียนการสอนแบบe-learning ควรจะมีกรณีศึกษา (Case Study)	1	2	3	4	5
2. การเรียนรู้แบบเป็นกลุ่ม (Collaborative Learning)					
2.1) การเรียนการสอนแบบe-learning สามารถช่วยสร้าง ชุมชนเพื่อการเรียนรู้ (Learning Community)	1	2	3	4	5
2.2) การเรียนการสอนแบบe-learning สามารถเพิ่มความรู้เกี่ยวกับวิชานั้นได้ด้วยการดูจากความคิดเห็นของผู้เรียนท่านอื่น หรือแลกเปลี่ยนความคิดเห็นในกลุ่มได้ (Group Discussion)	1	2	3	4	5
2.3) การเรียนการสอนแบบe-learning สามารถแบ่งปันข้อมูลข่าวสารในวิชาได้ (Sharing Ideas)	1	2	3	4	5
3. การโต้ตอบระหว่างอาจารย์กับนักศึกษาในวิชา (Interactivity)					
3.1) การเรียนการสอนแบบe-learning ช่วยให้มีการสื่อสารแบบโต้ตอบระหว่างอาจารย์กับนักศึกษาในวิชานั้นได้ (Two-way Communication)	1	2	3	4	5
3.2) การเรียนการสอนแบบe-learning โดยมีการสื่อสารแบบโต้ตอบระหว่างอาจารย์กับนักศึกษาในวิชา ทำให้เข้าใจเนื้อหาในวิชามากขึ้น	1	2	3	4	5
3.3) การเรียนการสอนแบบe-learning ช่วยให้เพิ่มความรู้เกี่ยวกับวิชานั้นได้โดยมีการโต้ตอบ ระหว่างนักศึกษากับนักศึกษาด้วยกัน	1	2	3	4	5
3.4) การเรียนการสอนแบบe-learning ช่วยผู้เรียนกล้าที่จะถามมากขึ้นเมื่อเทียบกับการเรียนการสอนแบบพบผู้สอน	1	2	3	4	5
3.5) อาจารย์ผู้สอนตอบคำถามทุกครั้งเมื่อผู้เรียนมีคำถามในการเรียนการสอนแบบe-learning	1	2	3	4	5
4. ผลลัพธ์ในการเรียนการสอนแบบe-learning (Learning Outcome)					
4.1) การเรียนการสอนแบบe-learning ช่วยให้มีความเชี่ยวชาญในสายอาชีพ	1	2	3	4	5
4.2) การเรียนการสอนแบบe-learning ช่วยให้ทำงานเสร็จเร็วขึ้น	1	2	3	4	5
4.3) การเรียนการสอนแบบe-learning สามารถให้ปริญญาแก่ผู้เรียนได้	1	2	3	4	5
5. ประสบการณ์ทางด้านคอมพิวเตอร์ (Computer Experience)					
5.1) การเรียนการสอนแบบe-learning ต้องมีความเชี่ยวชาญการใช้คอมพิวเตอร์สูง	1	2	3	4	5
5.2) การเรียนการสอนแบบe-learning ต้องมีความรู้ทางด้านภาษาอังกฤษอย่างดี	1	2	3	4	5

6. ประสบการณ์ทางด้านอินเตอร์เนต (Internet Experience)	ไม่เห็นด้วยอย่างมาก	ไม่เห็นด้วย	เฉยๆ	เห็นด้วย	เห็นด้วยอย่างมาก
6.1) ผู้เรียนในระบบการเรียนการสอนแบบe-learning จะต้องรู้จักการใช้อินเตอร์เนต	1	2	3	4	5
6.2) ผู้เรียนในระบบการเรียนการสอนแบบe-learning จะต้องรู้จักการใช้ e-mail	1	2	3	4	5
6.3) ผู้เรียนในระบบการเรียนการสอนแบบe-learning จะต้องรู้จักการใช้เครื่องมือเพื่อการค้นหาข้อมูล (Search Engine)	1	2	3	4	5
7. สนับสนุนทางด้านเทคนิคในการเรียนการสอนแบบe-learning (Technical Supports)					
7.1) ผู้เรียนจะต้องได้รับการแนะนำที่ดีเกี่ยวกับระบบการเรียนการสอนแบบe-learning ก่อนที่จะเริ่มเรียน	1	2	3	4	5
7.2) การเรียนการสอนแบบe-learning ต้องมีระบบเครือข่ายคอมพิวเตอร์ความเร็วสูง	1	2	3	4	5
7.3) การเรียนการสอนแบบe-learning ต้องใช้อุปกรณ์อิเลคทรอนิกส์อื่นๆ เช่น อินเตอร์เนต ซีดีรอม หรือโทรศัพท์มือถือ	1	2	3	4	5
8. ความเพลิดเพลิน (Enjoyment)					
8.1) การเรียนการสอนแบบe-learning ให้ความเพลิดเพลิน	1	2	3	4	5
9. ความสะดวก (Convenience)					
9.1) การเรียนการสอนแบบe-learning ให้ความสะดวกในเรื่องของเวลา	1	2	3	4	5
9.2) การเรียนการสอนแบบe-learning ให้ความสะดวกในเรื่องของสถานที่	1	2	3	4	5
10. การรับรู้ถึงประโยชน์ (Perceived Benefit)					
10.1) การเรียนการสอนแบบe-learning มีประโยชน์	1	2	3	4	5
11. การรับรู้ถึงความง่ายต่อการใช้งาน (Perceived Ease of Use)					
11.1) การเรียนการสอนแบบe-learning ง่ายต่อการใช้งาน	1	2	3	4	5
12. ทัศนคติของนักศึกษาที่มีต่อการเรียนการสอนแบบ e-learning (Attitude toward E-learning)					
12.1) การเรียนการสอนแบบe-learning มีสภาวะแวดล้อมในการเรียนที่น่าสนใจ	1	2	3	4	5
12.2) การเรียนการสอนแบบe-learning จะเป็นที่ยอมรับ	1	2	3	4	5
12.3) การเรียนการสอนแบบe-learning มีระบบการเรียนอย่างมีประสิทธิผล	1	2	3	4	5
12.4) ค่าเรียนในระบบการเรียนการสอนแบบe-learning ควรจะถูกกว่าค่าเรียนในระบบการเรียนในห้องเรียนทั่วไป	1	2	3	4	5
12.5) การเรียนการสอนแบบe-learning ช่วยลดค่าใช้จ่ายในการเดินทางไปมหาวิทยาลัย	1	2	3	4	5

13. กรุณาทำทำเครื่องหมายวงกลมรอบหมายเลขที่เหมาะสมที่สุดกับประโยคต่อไปนี้ ถ้าคุณมีโอกาสที่จะเรียนในระบบการเรียนการสอนแบบe-learning ในอนาคต	**ต่ำมาก**	**ต่ำ**	**ปานกลาง**	**สูง**	**สูงมาก**
13.1) ฉันจะปรึกษาเพื่อนที่มีประสบการณ์หรือมีความรู้ก่อนลงทะเบียนเรียนในระบบการเรียนการสอนแบบ e-learning	1	2	3	4	5
13.2) ฉันจะปรึกษาพ่อแม่หรือผู้ปกครองก่อนลงทะเบียนเรียนในระบบการเรียนการสอนแบบ e-learning	1	2	3	4	5
13.3) ฉันจะพิจารณาถึงชื่อเสียงของมหาวิทยาลัยที่มีระบบการเรียนการสอนแบบ e-learning	1	2	3	4	5
13.4) ฉันจะตรวจดูการรับรองของมหาวิทยาลัยที่มีระบบการเรียนการสอนแบบ e-learning	1	2	3	4	5
13.5) ฉันจะปรึกษาอาจารย์จากมหาวิทยาลัยก่อนจะลงทะเบียนเรียนในระบบการเรียนการสอนแบบ e-learning	1	2	3	4	5

14. ความตั้งใจที่จะลงทะเบียนเรียนในวิชาที่มีการเรียนการสอนแบบ e-learning	**ไม่เห็นด้วยอย่างมาก**	**ไม่เห็นด้วย**	**เฉยๆ**	**เห็นด้วย**	**เห็นด้วยอย่างมาก**
14.1) ถ้าฉันมีโอกาสที่จะเรียนในระบบการเรียนการสอนแบบe-learning ฉันสนใจที่จะลงทะเบียนเรียนในระบบการเรียนการสอนแบบe-learning	1	2	3	4	5

-- ขอบคุณมากครับ / ค่ะ --

Conference Paper

at

The Third National Conference on Electronic Business

(NCEB 2004)

FACULTY OF COMMERCE AND ACCOUNTANCY
CHULALONGKORN UNIVERSITY

Bangkok 10330, Thailand
Fax. (662) 2541824

5 November, 2004

Dear Ajarn Songsak Vanichviroon

I am pleased to inform you that you paper "An empirical Investigation of the Acceptance of E-learning by Thai University Students" has been a accepted for presentation in the Third National Conference on Electronic Business (NCEB 2004). The conference will be held at Chulalongkorn University during November 25 – 26, 2004. Your presentation is scheduled on November 26 from 2:30 – 3:00 PM.

Sincerely,

T. Arnuphaptrairong

Tharwon Arnuphaptrairong

Conference chair,
The Third National Conference on Electronic Business (NCEB 2004)

Cover Sheet

An Empirical Investigation of the Acceptance of E-learning of Thai University Students

By

Songsak Vanichviroon

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University of South Australia

and

Assumption University, Thailand

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An Empirical Investigation of the Acceptance of E-learning by Thai University Students

Abstract

Computer, the Internet, and other electronic devices have increasingly been used as tools for searching information and inter-communication. Similarly, many universities in Thailand have increased the use of Web-based technologies to supplement the learning systems. In order to implement an effective e-learning medium as a new learning system, we have to find out how university students accept this new technology.

The purpose of this study is to examine the acceptance of e-learning by Thai university students. Technology Acceptance Model (TAM) is used as a model to investigate the degree of acceptance of e-learning especially by Thai university students. Questionnaire is used to collect data from Thai university students who have participated in e-learning.

The result shows that course contents, collaborative learning, interactivity, and learning outcome are the factors that significantly influence on perceived benefit. Further, Internet experience, enjoyment and convenience are the factors that significantly influence on perceived ease of use. The findings show strong relationships between perceived benefit and students' attitude towards e-learning systems as well as between perceived ease of use and students' attitude towards e-learning systems. As the result of this study, students' attitude towards using e-learning systems has significantly effect on students' behavioral intention to use of e-learning systems.

1. Introduction

E-learning is becoming a factor of competitive advantages at many universities. The intense competition between higher education institutions has led to the need for finding ways in which competitive advantages might be enhanced. There are many benefits in adopting e-learning over traditional face-to-face learning. Students can gain new knowledge, search for new information, and interact with instructor or other students by e-learning at their convenience in terms of place and time. Several authors suggest that e-learning can enhance students learning performance and outcomes (Yi and Hwang, 2003; Koch, 1998 (cited in Valenta et al., 2001); Morrison, 2003). However, academic institutions realize that implementing an e-learning system is an expensive information technology.

In this paper, it is important to understand the students' attitudes toward e-learning as a new information technology tool to enhance students' learning. Some universities have adopted or are in the process of adopting e-learning to help students to save their time and be more convenient to learn any place either at home or at work by using e-learning systems.

However, there is no investigation about the acceptance of e-learning from student perspective in Thailand. A recent study (Stoel and Lee, 2003) suggested that when student's experience with a technology increases, they perceive it to be easier to use and more useful and are more likely to use it. In addition, they suggested that instructors should emphasize on how easy the technology is to use and how useful it is in improving grades. In order to gain competitive advantages in education, there is a need to investigate the students' acceptance of e-learning in higher education.

2. Technology Acceptance Model (TAM)

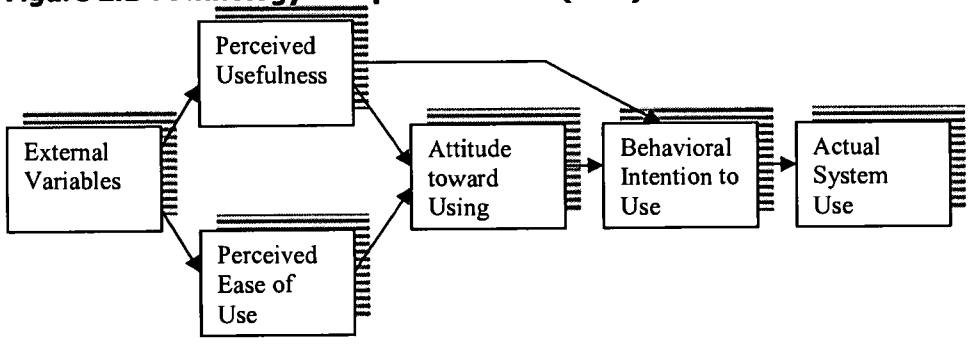
E-learning represents a learning system that uses ICT to facilitate and enhance learning. A number of studies have provided some theoretical frameworks for research in the acceptance of information technology and information system. In this paper, TAM model which many IS researchers have used to study individuals' acceptance of technology is used to investigate the acceptance of e-learning system from Thai university students. Based on several studies, TAM was found to be a strong predictor of intention to use a technology in various organizational and personal situations (Adams et al., 1992; Davis, 1989, 1993; Davis et al., 1989; Igbaria et al., 1995).

In TAM model, behavioral intention to use information technology was determined by perceived usefulness and perceived ease of use which are believed to be important

determinants in deciding on acceptance of information technology (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Liaw & Huang, 2003; Yi & Hwang, 2003; Lu et al., 2003). Perceived usefulness is defined as a user's subjective perception of a computer system or software that will enhance his or her work performance. Meanwhile, perceived ease of use refers to the extent in which the user expects a computer system or software to be easy to learn and use (Davis, 1989; Liaw & Huang, 2003; Lu et al., 2003). Both perceived usefulness and perceived ease of use will be variables that will lead to the attitude toward using e-learning system. With this model, behavioral intention to use e-learning system can be examined. As a study of Fishbein and Ajzen in 1975 (cited in Jackson, Chow, and Leitch, 1997), behavioral intention was defined as a measure of the strength of individual's intention to perform a specific behavior. Based on several research studies, Adams et al., 1992; Davis, 1989; Davis et al., 1989; Goodwin, 1987; Hill et al., 1987; Igbaria et al., 1997 (cited in Gahtani, 2001) the linkages between two key beliefs which are perceived usefulness and perceived ease of use identify as important factors for user acceptance criteria.

Figure 2.1, TAM model suggests that both perceived usefulness and perceived ease of use are instrumental in describing the variance in attitude. Agarwal and Prasad (1999) defines attitude as a learned implicit response that refers to an individual's evaluation of a concept. In order to explore students' acceptance of e-learning system, it is necessary to understand the factors that influence student perceptions toward e-learning system.

Figure 2.1 Technology Acceptance Model (TAM)



Source: Adapted from Davis (1989)

According to TAM, there are two main sections to measure university students' acceptance from their beliefs which are perceived usefulness and perceived ease of use and are important determinants in deciding on acceptance of e-learning systems (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Liaw & Huang, 2003; Yi & Hwang, 2003; Lu et al., 2003). The first section consists of four variables which are course contents, collaborative learning, interactivity, and learning outcome since these variables have an influence on perceived benefit of e-learning systems. Several studies argue that these variables are required in implementing effective e-learning (Morrison, 2003; Mauleon, 2003; Tian, 2001; Berry, 2000 (cited in Wild, Griggs, and Downing, 2002); Dillon and Gunawardena, 1995; Leidner and Jarvenpaa, 1993 (cited in Volery and Lord, 2000); Wild, Griggs, and Downing, 2002).

Another section consists of five variables which are computer experience, Internet experience, technological supports, enjoyment, and convenience because these variables have direct effect on perceived ease of use of e-learning systems. Several studies claim that these variables effect on effective e-learning (Morrison, 2003; Yamaguchi et al., 2003; Mauleon, 2003; Kozma, 2003; Selim, 2002; Evans and Haase, 2001; Stokes, 2000 (cited in Raab, Woods, and Abdon, 2003); University of Texas, 2000 (cited in Evans and Haase, 2001); Dillon and Gunawardena, 1995; Leidner and Jarvenpaa, 1993 (cited in Volery and Lord, 2000); Tian, 2001). These variables are crucial factors for the students to learn effectively.

3. Research Model and Questions

Figure 3.1, a proposed research model is presented based on TAM model. It is necessary to describe each variable to rationalize why they are required in investigating student acceptance of e-learning. First determinant that is important in this proposed model is perceived benefit. Four factors that influence e-learning program are course contents,

collaborative learning, interactivity, and learning outcome. The specific elements of the model and related questions are further discussed below.

Course Contents

Course contents include what kind of course contents are appropriate in e-learning program. According to a report from IDC (International Data Corporation) in 2000 (cited in Morrison, 2003), IT subject accounted for 72 percent of content demand worldwide. What kind of subject should be in e-learning courses? Should it be basic, advanced, or practical subject? Should it include case studies in the course content? It is easier to develop learning content about hard skills than soft skills. There is a bias against using e-learning for soft contents (Morrison, 2003) because it is more difficult to handle it and to influence learners' behaviors. In order to solve this problem, powerful technology is used to create richer interfaces such as simulations. However, Selim (2002) and Morrison (2003) suggested that course material should be available anytime anywhere so that learners are able to download them. Therefore, the researcher questions that:

Q1: What is the effect of course contents on student perceived benefit?

Collaborative Learning

Collaborative learning increases achievement under certain conditions and it tends to increase the ability of students to negotiate and be more tolerant of others (Salter, 2003). Similarly, it may result in improving ability to see the world from another person's point of view, better relations among different ethnic groups in schools and classrooms, increased self-esteem, greater acceptance of handicapped and low-achieving students (Woolfolk, 1995). E-learning program can help build learning community. Barreau et al., 1999, (cited in Valenta et al., 2001) reported that students formed good working relationships, felt equality in their contributions, and felt that group work enabled them to produce higher quality projects. Moreover, e-learning can promote group discussion and share the idea among e-learners. In a work of Hiltz, 1998, (cited in Valenta et al., 2001) it was indicated that 55 percent of students felt more motivated to work hard on their assignments because other students would be reading them. Therefore, the researcher questions that:

Q2: What is the effect of collaborative learning on student perceived benefit?

Interactivity

Interactivity allows two-way communication between students and lecturer and among the students. Students perceived that they receive more individual attention from instructors in e-learning (Valenta et al., 2001). The expectation of interaction from e-learning system is on the learner's part (Morrison, 2003). Morrison (2003) argues that interactive learning stimulates and motivates learners to acquire new knowledge and skills. Many tools students can use to improve their knowledge and communication skill are chat room and web board. On the other hand, students can get information quickly from instructors either synchronously or asynchronously. Therefore, the researcher questions that:

Q3: What is the effect of interactivity on student perceived benefit?

Learning Outcome

Learning outcome is one of the most important factors that influence students to enroll in e-learning program. Some students want to learn to gain knowledge for their career and increase their skill, some want to get the degree. Yi and Hwang (2003) stated that learning goal of students is to understand something new or to enhance their level of competence. In fact, e-learning should enhance student performance and allow students to earn a degree. Morrison (2003) argues that e-learning is a key of the university performance improvement strategy. In Koch's study in 1998 (cited in Valenta et al., 2001), it was stated that students in distance education earned higher grades than ones in traditional classroom. However, many students expect to have better skills for their career in e-learning course.

Online environments facilitate learning outcomes that are equal or superior to those generated in the face-to-face situation (Hiltz, 1988, 1994; Wells, 1990 (cited in Brooks, Nolan, and Gallagher 2001); Schulman & Sims, 1999). These studies show that using computer and Internet technology for education can improve students' learning performance. Therefore, the researcher questions that:

Q4: What is the effect of learning outcome on student perceived benefit?

Another determinant that is important in this proposed model is perceived ease of use. Five factors that influence e-learning program are computer experience, Internet experience, technological supports, enjoyment, and convenience. These factors will be discussed in the following pages.

Computer Experience

Computer experience is an important factor for students to study e-learning program. Morrison (2003) stated that learners who need to study e-learning should know how to use computer well enough to take advantage of e-learning. Many researchers such as Dabholkar, 1992, 1996; Dickerson & Gentry, 1983; Korgaonkar & Moschis, 1987, (cited in Lu et al., 2003) and Liaw and Huang (2003) believed that past experience of using similar technologies contributed greatly to favorable attitudes toward using a new technology and actual adoption. However, students in e-learning may require high computer skill and knowledge of English language. Therefore, the researcher questions that:

Q5: What is the effect of computer experience on student perceived ease of use?

Internet Experience

Internet experience is one of the most important factors for e-learning. Students who want to study e-learning program have to know how to use Internet since it is mainly used in the program. In a study of Agarwal and Prasad (1999), Internet use experience is believed to be a strong influencing factor on intention to use a specific system through perceived ease of use. Further, students are required to use e-mail and search engine. Therefore, the researcher questions that:

Q6: What is the effect of Internet experience on student perceived ease of use?

Technological supports

Technological supports are very important factors for e-learning program because students who may use these technologies for their study will need a clear guide and instruction to use them. However, the speed of the network may be an issue of e-learning. Mastrian & McGonigle, 1997, (cited in Valenta et al., 2001) stated that the most negative comment related to the overall experience was the frustration felt by students in the use of computer. Therefore, the researcher questions that:

Q7: What is the effect of technological support on student perceived ease of use?

Enjoyment

Enjoyment means the satisfaction felt by students in using computer system (Davis et al., 1992). Teo et al. (1999) found that perceived enjoyment was one motivational factor for the use of the Internet. Previous studies showed that the effect of enjoyment on ease of use became stronger as users gained more direct experience with the system (Venkatesh, 2000; Venkatesh et al., 2002). Similarly, in the studies of Davis et al. (1992) and Venkatesh and Speier (2000), enjoyment is classified as a type of intrinsic motivation of information system users. It is well known that when people are intrincsically motivated, they become productive and effective (Csikszentmihalyi, 1990). Moreover, enjoyment has a significant influence on usefulness via ease of use (Venkatesh, 2000). A recent study of Yi and Hwang in 2003 showed that enjoyment was one of the sub-dimensions of cognitive absorption with the highest loading score. The system perceived to be easier to use is considered to be more enjoyable. Therefore, the researcher questions that:

Q8: What is the effect of enjoyment on student perceived ease of use?

Convenience

Convenience is another factor that allows learners to participate in e-learning program at any time and anywhere. Morrison (2003) stated that students are beginning to demand that their learning take place at a time, place, and pace convenient to them. Similarly, Phillips et al. (2000) pointed out advantage of building e-learning that could save both time and money. Learners can learn and communicate directly with instructors and other learners through synchronous learning (Morrison, 2003) which is a real time learning tool such as a virtual class, chat room, or Instant Messaging technologies for peer-to-peer communication. Learners can

also learn when they want to by using asynchronous learning tools such as electronic discussion board or Web board, and e-mail to communicate with instructors and other learners. Therefore, taking an e-learning program is another option for everyone to increase their knowledge and skills by learning at their convenience in place and time. Therefore, the researcher questions that:

Q9: What is the effect of convenience on student perceived ease of use?

Perceived Benefit

Many previous studies have mentioned TAM model which focus on users' perception of usefulness that influences the use of information systems (Davis, 1989; Davis et al., 1992; Venkatesh, 2000; Agarwal and Prasad, 1999; Teo et al., 1999; Yi and Hwang, 2003; and Liaw and Hwang (2003). Phillips et al. (2000) indicates that most of the current evaluation of e-learning program has been driven by users or learners. The studies of Chau (1996) and Jiang et al. (2000) developed utilization of the Internet technology model to explore user acceptance of Internet. The testing the utilization of the Internet technology model confirmed that utilization of the Internet is positively related to perceived usefulness. Therefore, the researcher questions that:

Q10: What is the effect of perceived Benefit on students' attitude towards using e-learning systems?

Perceived Ease of Use

Perceived ease of use is another major determinant of attitude toward the use of e-learning in TAM model. The internal belief ties to an individual's assessment of the mental effort involved in using a system (Davis, 1989). Improvement in perceived ease of use may contribute to improved performance (Lu et al., 2003). However, many studies confirmed the effect of ease of use on attitude toward system use (Al-Gahtani and King, 1999; Lu and Gustafsen, 1994; Moore and Benbasat, 1991; Venkatesh and Davis, 1996). Venkatesh (2000) believed that for any emerging information technology or information system, perceived ease of use is an important determinant of users' intention of acceptance and usage behavior. Therefore, the researcher questions that:

Q11: What is the effect of perceived ease of use on students' attitude towards using e-learning systems?

Attitude towards Using

Attitudes are seen as users learned tendencies to evaluate an object for instance e-learning system in a consistently favorable or unfavorable way (Assael, 1995; Mowen and Minor, 1998; Schiffman and Kanuk, 2000). In the same fashion, attitude is defined as an enduring combination of motivational, emotional, perceptual and cognitive processes with respect to some aspect of our environment (Neal, Quester, and Hawkins, 2002).

In this study, students' attitude towards using e-learning will be explored. Many researchers have adopted TAM model in their studies, however, some have not included attitude towards using variable in their studies. This study also included attitude towards using as mentioned in several studies (Lu et al., 2003; Malhotra and Galletta, 1999; Stoel and Lee, 2003). Therefore, the researcher questions that:

Q12: What is the effect of students' attitude towards e-learning systems on behavioral intention to use e-learning systems?

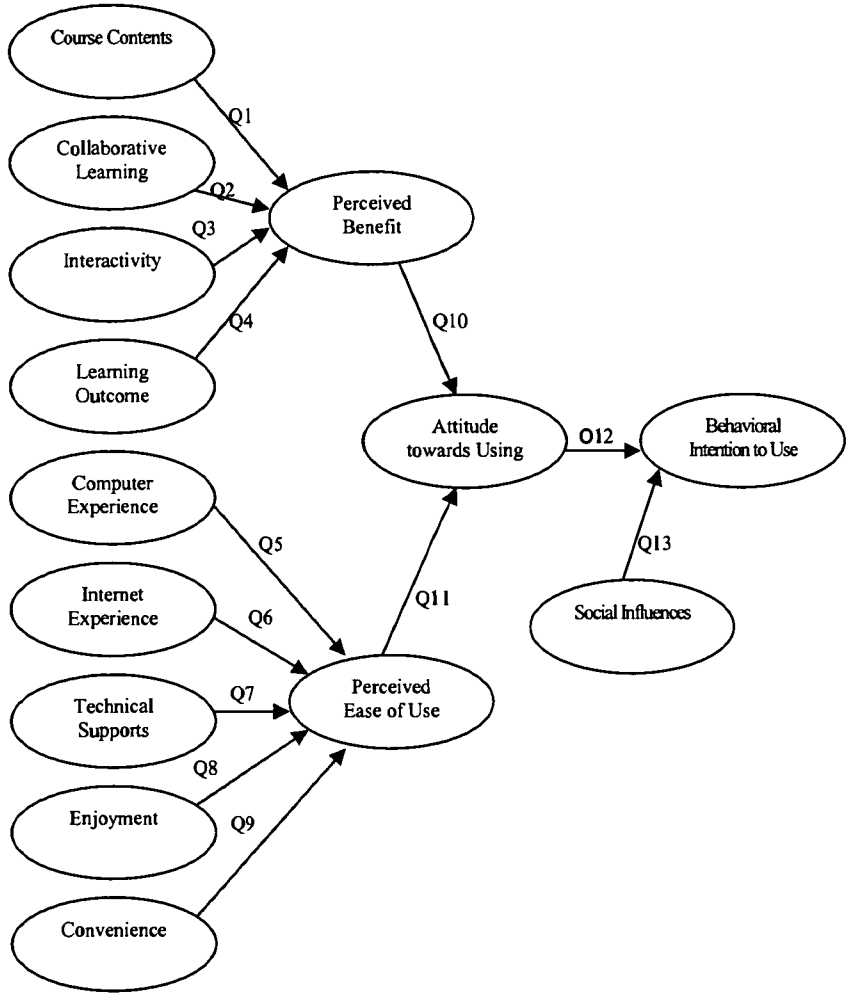
Social Influences

Social influences were equivalent to subjective norm and defined as other people's opinion, superior influence, and peer influence (Taylor and Todd, 1995). Moore and Benbasat (1991) pointed out that the use of an innovation is perceived as enhancement of one's status in a social system. However, Davis et al. (1989) believed that in some cases people might use a system to comply with others' mandates rather than their own feelings and beliefs. Prior studies support the relationship between social norms and behavior (Tornatsky and Klein, 1982; Venkatesh and Davis, 2000). In this study, students' peer, parents, and lecturer are social influences that might effect on students' decision making to enroll in e-learning program. Therefore, the researcher questions that:

Q13: What is the effect of social influences on behavioral intention to use e-learning systems?

According to a study of Davis et al. in 1989 (cited in Agarwal and Prasad, 1999), the internal psychological variables such as beliefs which are central to TAM fully mediate the effects all other variables in the external environment on an individual's use of an innovation. Figure 3.1 illustrates a proposed research model of students' acceptance of e-learning in Thailand which is constructed based on TAM model.

Figure 3.1 Proposed Model of Predicting the Use of E-learning in Thailand



A model developed for this study

4. Research Methodology

In this study, a questionnaire survey is used because it is a positivistic methodology whereby a sample of subjects is drawn from a population and studied to make inferences about the population (Hussey and Hussey, 1997).

4.1 Study context and sample

In this study, Thai public university students who participated in e-learning systems will be surveyed. The population will be both undergraduate and graduate students who had taken e-learning course in Thailand. Since e-learning system in Thailand is at the initial stage, not many public universities had adopted e-learning systems. Two public universities will be randomly selected since simple random sampling has the least bias and offers the most generalizability (Sekaran, 2000). The questionnaires were answered by 420 students who are conveniently available to provide information in each university. A total of 406 are usable responses collected from the respondents representing 96.67% as a response rate.

4.2 Data Collection

In this research study, the questionnaire used for data collection contained scales to measure the various constructs depicted in the research model. The questionnaire will be on a

5-point scale from strongly disagree to strongly agree because a 5-point scale is as good as any, and an increase from 5 to 7 or 9 points on rating scale does not improve the reliability of the ratings (Elmore and Beggs in 1975 (cited in Sekaran, 2000).

Pre-testing and pilot testing of the measures were done by selecting 31 university students who participated in e-learning systems. The students will be asked whether they have participated e-learning system in their class before answering the questionnaire. The completed questionnaire will be returned to the researcher after students finish all questions in the questionnaire.

5. Results and Analysis

There are two sections in the results and analysis. The first section is the descriptive statistics of a population or sample in the form of frequency. The second section is the inferential statistics which test the relationship upon each question.

5.1 Descriptive Analysis

This section explains the information about a population or sample (Zikmund, 1997) in the form of frequency and percentage. However, the questionnaire is highly creditable because the robustness of the scale was assessed by internal consistency reliabilities as indexed by Cronbach's coefficient alpha, account for 94.1%.

In this study, females and males comprise 73.65% and 26.35% of the respondents, respectively. Majority of respondents are undergraduate students which accounted for 402 and only 4 graduate students participated in this study. Most of the respondents were below 20 years of age which accounted for 88.42% and have no income which accounted for 70.94%, only 28.82% of all respondents have income less than 20,000 baht. Of all respondents, only 25 students are working while they study, with only 1 student working as full-time. Most participants are from Arts, Business Administration, Social Science, and Software Development majors and have cumulative Grade Point Averages between 2.5 and 3.5, which accounted for 67% of the respondents.

The result shows that majority of respondents is students' parents who responsible for tuition and fees and accounted for 94.33% of all respondents. Only 1.23% of all respondents pay tuition and fees by themselves. Students, whose relatives pay their tuition and fees, account for 1.97% of the respondents. About 1 percent of all respondents pay their tuition and fees by their institution. The respondents from faculty of Arts accounted for 13.55% of all respondents while the respondents from faculty of Business Administration accounted for 14.53%. The respondents from faculty of Social Administration accounted for 15.27% of all respondents while the respondents from faculty of Sociology and Anthropology accounted for 15.76%. The respondents from faculty of Development Software accounted for 17.98% of all respondents. Moreover, the other respondents are from other faculties, which are Science, Engineering, Bio Technology, Architecture, Communication Art, Economic, Medicine, and Journalism, accounted for 22.41%.

Meanwhile, majority of respondents is expecting grade B for the course, accounted for 37.19%. The respondents who expect grade B+ for the course, accounted for 21.18% while C+ accounted for 14.04%. Only 10.84% of all respondents expect A for their grade for the course. The respondents who expect grade C for the course, accounted for 7.64% while B- accounted for 5.17%. To my surprise, 2.71% of all the respondents expect their grade below C for the course.

Moreover, most respondents spent their time from their residence to university less than 30 minutes which accounted for 65.27%. About 19.70% of all respondents spent 30 to 60 minutes of their time for traveling from their residence to university while the respondents spent their time from 1 hour to 2 hours accounted for 12.81%. Only 2.22% of all respondents spent more than 2 hours from their residence to university.

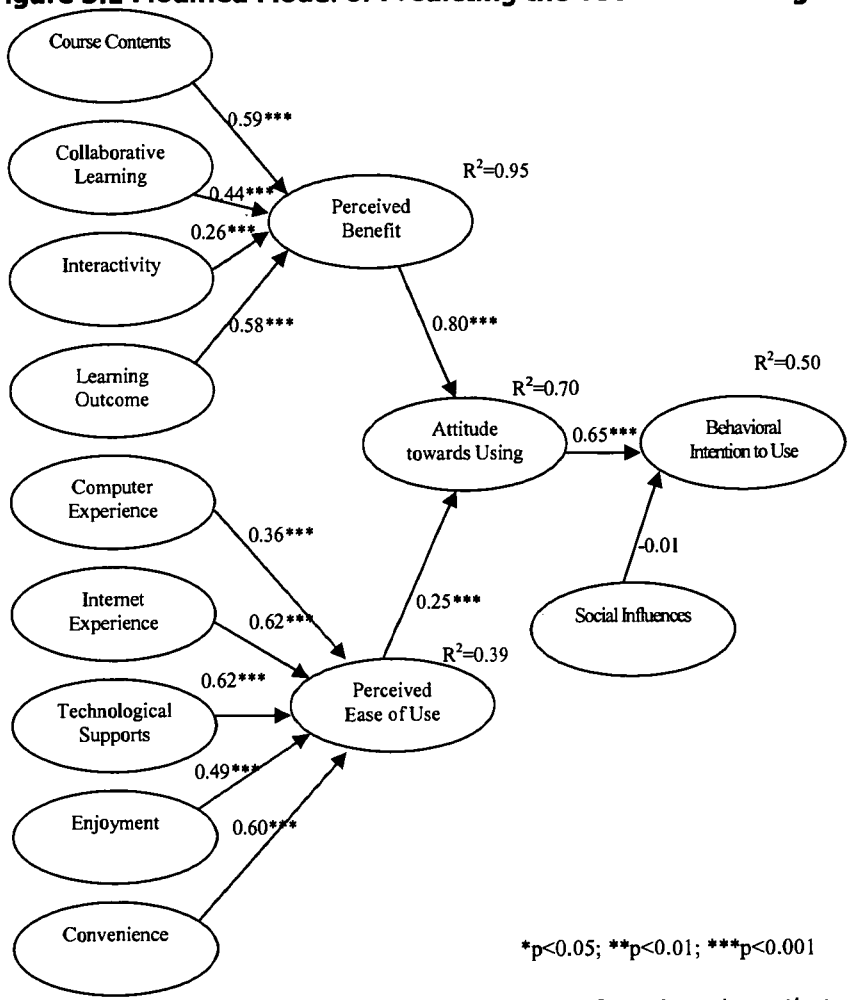
5.2 Referential Analysis

In this section, the testing causal relationship is described by structure equation model analysis. The second section of data analysis consists of factor analyses to identify and confirm factors and the assessment of factor reliability. All the scales were factor-analyzed with the iterated principal components method and varimax rotation using the PC version of SPSS 11.0. In reducing the number of variables, factor analysis procedures attempt to reduce as much of the information overlap as possible and to make the remaining variables as meaningful and as easy to work with as possible.

This research study has started the process of field study from September to October 2004 which is the period of after mid-term examination. The collected data was entered into SPSS program before transforming the data to be analyzed by AMOS for the proposed construct of students' acceptance of e-learning as presented below.

For this study, chi-square, goodness-of-fit index (GFI=0.76), adjusted goodness-of-fit index (AGFI=0.70), and root mean square error of approximation (RMSEA=0.095) were used to confirm the overall fit of the model to the data which is quite good.

Figure 5.1 Modified Model of Predicting the Use of E-learning in Thailand



As illustrated in figure 5.1, the results of testing show that the model in this study supports Q1, course contents had a significant effect on perceived benefit (β=0.59, p<0.001). Supporting Q2, collaborative learning had a significant effect on perceived benefit (β=0.44, p<0.001). Supporting Q3, interactivity had a significant effect on perceived benefit (β=0.26, p<0.001). Supporting Q4, learning outcome had a significant effect on perceived benefit (β=0.58, p<0.001).

The findings also show the results that support Q5, computer experience had a significant effect on perceived ease of use (β=0.36, p<0.001). Supporting Q6, Internet experience had a significant effect on perceived ease of use (β=0.62, p<0.001). Supporting Q7, technological supports had a significant effect on perceived ease of use (β=0.62, p<0.001). Supporting Q8, enjoyment had a significant effect on perceived ease of use (β=0.49, p<0.001). Supporting Q9, convenience had a significant effect on perceived ease of use (β=0.60, p<0.001).

However, the results show a strong relationship between perceived benefit and attitude towards using (β=0.80, p<0.001) which supports Q10 and also supporting Q11, perceived ease of use had significant effect on attitude towards using (β=0.25, p<0.001). Supporting Q12, attitude towards using had significant effect on behavioral intention to use (β=0.65, p<0.001). However, social influences had no significant effect on behavioral intention to use (β= -0.01,

p>0.05). Therefore, the question Q13 will be rejected or there is no relationship between social influences and behavioral intention to use. Table 5.1 illustrates the estimate value and p-value of each relationship.

Table 5.1 Regression Weights of Proposed Model

			Estimate	P
Perceived Benefit	<---	Course Contents	0.593	***
Perceived Benefit	<---	Collaborative Learning	0.444	***
Perceived Benefit	<---	Interactivity	0.26	***
Perceived Benefit	<---	Learning Outcome	0.58	***
Perceived Ease of Use	<---	Computer Experience	0.358	***
Perceived Ease of Use	<---	Internet Experience	0.621	***
Perceived Ease of Use	<---	Technical Supports	0.62	***
Perceived Ease of Use	<---	Enjoyment	0.491	***
Perceived Ease of Use	<---	Convenience	0.595	***
Attitude Toward Using	<---	Perceived Benefit	0.796	***
Attitude Toward Using	<---	Perceived Ease of Use	0.252	***
Behavioral Intention to Use	<---	Social Influences	-0.012	0.835
Behavioral Intention to Use	<---	Attitude Toward Using	0.651	***

In summary, the proposed model test supported all the questions except Q13. However, the findings also explained variance in perceived benefit (R^2=0.95), perceived ease of use (R^2=0.39), attitude towards using (R^2=0.70), and behavioral intention to use (R^2=0.50).

6. Discussions

The TAM model proposed by Davis et al. (1989) was a successful model to study student acceptance of information technology or information systems. As the results, the modified model suggests the general applicability of TAM to university student use of e-learning systems. One important contribution of this study is that it extends the domain of the TAM to student acceptance of e-learning systems.

This study addressed an important gap in the literature by examining the effect of student experience with their acceptance of the e-learning over a period of time. Little research has examined student acceptance of e-learning, so the current research provides information to educators that may be helpful in engaging students to use e-learning systems.

The results clearly point out the important roles of all determinants (course contents, collaborative learning, interactivity, and learning outcome), which have significant effect on perceived benefit. The results also indicate other key determinants (computer experience, Internet experience, technological supports, enjoyment, and convenience) which have significant effect on perceived ease of use. These are also the key factors that influence students to use e-learning systems.

As the results of this study, attitude towards using significantly influenced on behavioral intention to use of e-learning system (β=0.65, p<0.001). Similar findings from studies of Stoel and Lee (2003); Davis (1989) reported that attitude towards using significantly influenced behavioral intention to use. Perceived benefit significantly influenced attitude towards using (β=0.80, p<0.001). Similar findings were reported by Stoel and Lee (2003); Davis (1989); and Hu et al. (1999). Perceived ease of use had significant direct effect on attitude towards using (β=0.25, p<0.001). Similar findings were reported by Stoel and Lee (2003); Davis (1989); Davis et al (1989).

The findings of this study indicate all four major critical factors for the perceived benefit of e-learning systems. Course content has a strong significant effect on perceived benefit (β=0.59, p<0.001). Collaborative learning significantly influenced perceived benefit (β=0.44, p<0.001). Interactivity significantly influenced perceived benefit (β=0.26, p<0.001). Learning outcome significantly influenced perceived benefit (β=0.58, p<0.001).

As the results in this study reveal students' computer experience significantly influenced on perception of ease of use (β=0.36, p<0.001). Students' Internet experience significantly influenced on perception of ease of use (β=0.62, p<0.001). Similar findings from study of Agarwal and Prasad (1999); Stoel and Lee (2003) reported that experience of using Internet

technology significantly influenced on perceptions of ease of use (β=0.14, $p<0.001$). Technological supports significantly influenced perception of ease of use (β=0.62, $p<0.001$). Enjoyment had a strong significant effect on perceived ease of use (β=0.49, $P<0.001$). Similar findings reported by Liaw & Hwang (2003); Venkatesh (2000). Moreover, convenience significantly influenced perception of ease of use (β=0.60, $p<0.001$).

However, this study did not survey students' responses at different times. This study is consistent with prior studies on user acceptance of technology (Davis, 1989; Agarwal et al., 1996; Agarwal and Karahanna, 2000) as well as avoids methodological problems associated with the multiple administration of the same instrument (Cook and Campbell, 1979). In addition, this study was conducted with young undergraduate students. Future research may be focusing more on senior students or graduate students who may have more self-discipline for their study and usually they are more likely to be goal-directed learners.

7. Conclusions

E-learning systems will be an effective learning tool for active learners because it provides students with course materials and other information on the Internet that they can access any time anywhere. They also can interact with instructors and students or other experts to share ideas and information about the courses. Moreover, students can finish assignment and project by using many tools from e-learning and they can get better grade when they study by e-learning systems. However, acceptance of e-learning from students is very important topic for academic institutions that want to implement an e-leaning program. Therefore, study about individual students' attitudes is necessary before putting a big investment for e-learning systems.

The findings confirm previous studies that course contents, collaborative learning, and learning outcome are the key indicators that predict individual students' perceptions to the benefit of e-learning systems for Thai universities. Similarly, it confirms previous studies that computer experience, Internet experience, technological supports, enjoyment and convenience are the key indicators that predict individual students' perception to the ease of use of e-learning systems. Beside, the current study shows that students' attitude towards using e-learning that predicted on whether students agree e-learning system is beneficial to them or they feel it is easy to use e-learning. Moreover, attitude towards using e-learning is confirmed to be a predictor of behavioral intention to use e-learning systems.

The results indicate critical ease of use factors for effective e-learning course which enable students to accomplish their works faster. It also makes studying course material much easier by having the course material available anytime anywhere, facilitating communication between students and instructors or among students. Moreover, instructors can use interactive tools such as Webboard and chat room to explain course contents.

Further, computer playfulness and enjoyment which are all intrinsic motivation seem to be major determinants of e-learning system use achieving their effects indirectly through ease of use and usefulness (Venkatesh, 2000). The same finding from Davis, Bagozzi, and Warshaw (1992), intrinsic motivation or enjoyment was a key driver of behavioral intention to use computer. It is critical to understand how to motivate students to learn when implementing an effective e-learning. For future study, it might be focusing on how to motivate students to learn in e-learning systems. Further research will focus on enjoyment or intrinsic motivation which is a determinant of perceived ease of use from the result of this study.

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