DISSERTATION

DIFFUSION OF INFORMATION AND LEARNING TECHNOLOGY AMONG CAREER AND TECHNICAL EDUCATORS IN MALAYSIA

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2006

COLORADO STATE UNIVERSITY

May 8, 2006

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY ABDULLAH MAT RASHID ENTITLED DIFFUSION OF INFORMATION AND LEARNING TECHNOLOGY AMONG CAREER AND TECHNICAL EDUCATORS IN MALAYSIA BE ACCEPTED AS FULFILING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

DIFFUSION OF INFORMATION AND LEARNING TECHNOLOGY (ILT) AMONG CAREER AND TECHNICAL EDUCATORS IN MALAYSIA

This study investigated the diffusion of ILT among career and technical educators in Malaysia. The study was conducted at a large career and technical institute and used a non-experimental approach. The study explored the associations and differences of gender, personal computer ownership, years of teaching experience, self-reported knowledge, barriers, institutional supports, and usage of ILT.

Results showed that majority of faculty members reported that ILT are important as teaching tools, yet the results suggest that few faculty members are using it in teaching practices. Compared to male, female faculty members owned more personal computers. Faculty members who owned a personal computer rated their knowledge (t (121) = 2.38, $p < .019$), usage (t (121) = 2.54, $p < .001$), satisfaction (t (121) = 4.55, $p < .001$), and supports (t (121) = 5.37, $p < .001$) slightly higher than those who did not own a personal computer. Further, faculty members who owned a personal computer rated their barriers slightly fewer (t (121) = -3.38, $p < .001$) than those who did not own a personal computer.

There were significant main effects of gender on knowledge (F (1, 119) = 5.34, $p < .05$), of gender on satisfaction, (F (1, 119) = 6.20, $p < .05$), of personal computer ownership on satisfaction, (F (1, 119) = 11.28, $p < .01$), of personal computer ownership

on barriers, (F (1, 119) = 5.34, $p < .05$), and of personal computer ownership on supports, (F (1, 119) = 18.32, $p < .01$).

The results of multiple regression revealed that the best predictors for knowledge were usage and satisfaction ($R^2 = .599$; F (7, 115) = 24.55, $p < .001$). Further, the best predictors of usage were knowledge and satisfaction ($R^2 = .558$; F (2, 120) = 75.88, $p < .001$). The findings revealed that career and technical faculty members were most comfortable using familiar technology including the Internet, word processing, and presentation software.

The study suggests that career and technical training facilities in Malaysia should address general barriers and increase both technological and pedagogical supports to successfully implement ILT in teaching and learning practices.

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ACKNOWLEDGEMENTS

I am sincerely grateful to my advisor, Dr. Gene W. Gloeckner, for his guidance, encouragement, and advice throughout my program and dissertation process. A special appreciation is extended to the committee members: Dr. George A. Morgan, Dr. Clifford Harbour, and Dr. James E. Folkestad for their knowledge, expertise, and ideas that helped me clarify my thoughts and direct my study. Special thanks go to my parents and wife for their prayers, understanding, patience, love, cheering me on, having faith in me, being my friends and listening ears, being there for me, and for having the desire for me to succeed.

My thanks also go to the following: my friend, Dr. Pamela Dixon, for her support and proof reading; to Dr. Spotts and Dr. Groves, for allowing me to use their instrument; to Mr. Nidzam Kamarulzaman, for his support and allowing me to conduct the study at the CIAST; to Mr. Rahmat Ayob, for his support and patience; to other family members and friends, I say thank you for all your prayers, encouragement, and support. And to all those who helped in some way and who are too numerous to mention here, I appreciate all your contributions. Thank you.

DEDICATION

In loving memory of my beloved father,

Mat Rashid @ Mat Idris Awang Chik

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CHAPTER 1: INTRODUCTION

The knowledge economy revolution has pushed most developed nations into an era which demands effective utilization of information and communication technology in learning institutions (Maeir & Warren, 2000). Countries like the United States, the United Kingdom, Japan, and Australia, which have embraced information and communication technology are experiencing strong economic growth and are well positioned to take advantage of this opportunity. These countries have encouraged their people to enhance information and communication technology skills through education and life long learning. Information and communication technology transformed itself into virtually every corner of the knowledge economy (French, 1999).

The Aspen Institute (2002) acknowledged that the knowledge economy demands people with education and training beyond high school because of increasing skill requirements for the jobs. A foundation of solid academic skills as well as soft skills is expected by employers to deal with the knowledge economy workplace environment (Carnevale, 2000; Feller & Wichard, 2005; Rao & Sylvester, 2000). Soft skills such as problem solving, information and communication technology literacy, and teamwork are valuable in strengthening an academic skills foundation in order to survive with an accelerating pace of change.

Ken Wasch, the President of Software and Information Industry Association (SIIA) in *International Society for Technology in Education* (2004), stated technology in schools is critical to ensuring that all students gain 21st century skills necessary for

success by engaging them in the learning process. Information and communication technology has provided tools to help in the teaching and learning processes. The advantages of information and communication technology benefit educators by expanding choices for teaching and facilitating the learning process and providing opportunities to reflect on effective teaching practices. It enables educators to explore how to exploit the potential of these tools to enrich student learning and help manage the workload such as grading and tracking student attendance.

The number of educators willing to invest time and effort to integrate information and learning technology into their courses may begin to level off (Lynch, 2002). Research findings show the reasons include lack of institutional support, lack of recognition of efforts, lack of financial support, lack of time to learn new technologies, and the fact that information and learning technology can be a source of stress. The pressure faced by the educators to utilize technology in their teaching is coming from administrators and from students (Bennett & Bennett, 2003; Chin, 2004). Lynch (2002) noticed the biggest obstacle to applying information and learning technology in the classroom is educators' unwillingness to use the technology made available to them. Findings of research suggest that information technology may have effects on the nature of office work, job satisfaction, and the quality of individual social interaction and work (Bennett & Bennett, 2003; Igbaria & Tan, 1997).

Information and Learning Technology

The phrase information and learning technology is widely used to describe the use of information technology and information and communication technology for the purposes of teaching and learning. Hill (2003) indicated the term was emerging and

defined it as the use of information and communication technology for the purpose of teaching and learning processes. Morrison and Dede (2004) defined information and learning technology as technology tools that allow users to customize their access to information as they make decisions in an inquiry. For the purposes of this study, the phrase information and learning technology will refer to any device that allows users customized and applied access to achieve the objective of teaching and learning. Hill (2003) summarized the differences between several phrase related to information and learning technology as show in Table 1 and Figure 1.

Table 1

Definition, Skills, and Examples of Information and Learning Technology

Term	Description	Skills Needed	Example of Use by an Educator
Information Technology (IT)	Computer hardware and software	Skills to use a kit and its specific applications	Prepare a handout using word processor
Information and communication technology (ICT)	Computers linked together to form networks	Skills to use the communications facilities	Send an email
Information and Learning Technology (ILT)	Computing applied to the whole of business of higher education institutions	1. Teaching and learning skills 2. Learner management skills 3. Information technology and information and communication technology skills	Online enrollment

Note. Adapted from *Teaching and Learning Using Information and Learning Technology*, by C. Hill, 2003, p. 16.

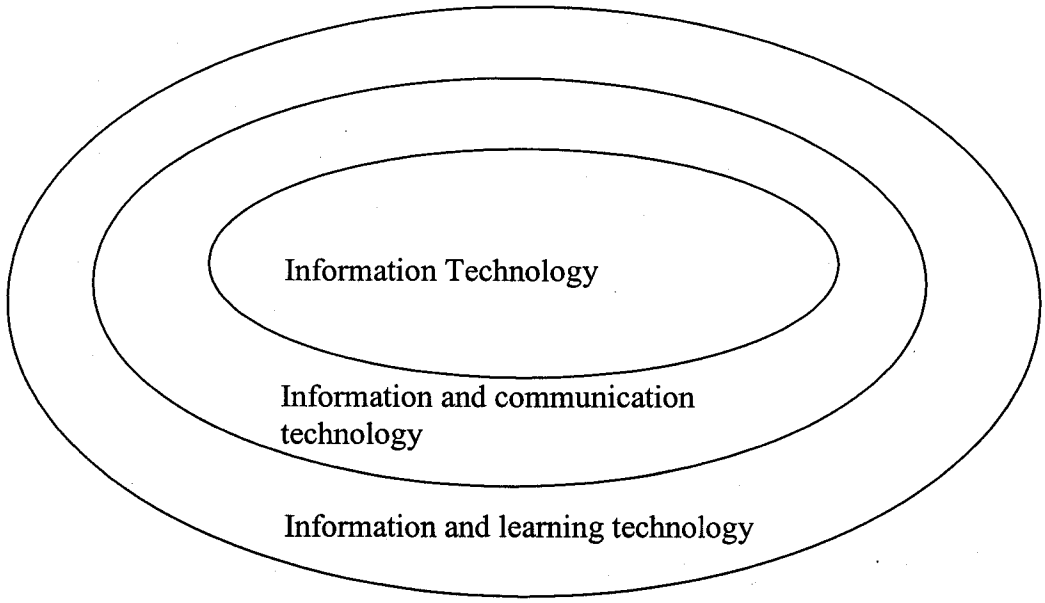

Figure 1. The relationship between information technology, information and communication technology, and information and learning technology adapted from Teaching and Learning Using Information and Learning Technology by C. Hill, 2003, p. 15.

Figure 1 shows the relationships among information technology, information and communication technology, and information and learning technology. The concept of information technology is restricted to the tools such as a stand alone computer. While a stand alone computer connected to other tools like printer or other hardware, the term is information and communication technology. The concept is called information and learning technology when the purpose of information and communication technology is for teaching and learning, including the management of the learning environment and business system of the institutions such as online registration.

Study Context and Scope

The proliferation of information and communication technology has provided educators with user friendly and easy to use productivity tools, access to multimedia applications, and virtual simulations to support the teaching and learning process. The Malaysian government has emphasized information and communication technology and financially supported its adoptions as a tool to facilitate and foster educational outcomes through expansion with programs of computerization. It provides wide-ranging content and networking opportunities for educational institutions in Malaysia.

In the 2005 budget, the Malaysian government will allocate a total RM19.3 billion ($5.28 billion – U.S. equivalents as of April 2006) for the development of the education sector to provide better information and communication technology facilities to schools and students (Ministry of Finance, 2004). It is important to understand educators' self-reported knowledge, satisfaction, and usage of information and learning technology to measure accountability and to evaluate outcomes of government funding programs. Bennett and Bennett (2003) noticed that despite the increased pressure being placed on teachers to integrate technology in courses, many are reluctant to adopt the technology. Young (2002) described that the reluctance to embrace technology is due to many factors including the amount of time and effort required to properly integrate technology into curriculum and persistent doubts about the pedagogical benefits of the technology being utilized.

Rogers (2003) noted that whether individuals adoption of innovations depends on the degree to which an innovation is perceived as being better than the idea it supersedes. According to Kobulnicky, Ruby, and the Educause Current Issues Committee (2002) and

Lynch (2002), the information technology administrators identified the most critical issues that contribute to integrating technology into teaching practices as faculty development, support, and training. The scope of this study focused on exploring the relationship of several variables related to faculty development, support, and training that likely contribute to adoption of information and learning technology among career and technical educators in Malaysia. The variables include self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, gender, years of teaching, and personal computer ownership.

Bennett and Bennett (2003) confirmed factors that have positive impact on teachers' attitudes and beliefs to adopt technology, including the relative advantages of instructional technology, demonstrations of how technology can be utilized to enhance teaching and learning, opportunities to 'test-drive' the technology, consideration of the teachers' level of comfort with technology, and explanation of how the technology fits teachers' values and philosophies of teaching. Chizmar and Williams (2001) and Wilson (2003) agreed with the Bennett and Bennett (2003) findings on diffusion of information and learning technology. However, according to Saunders and Kleming (2003), the rapid and widespread adoption of information and learning technology approaches could fail as a consequence of the inability of educators to adapt information and learning technology to suit the process of teaching.

Findings from Mukti (2000) showed that teacher background characteristics, attitudes, and concerns have significance in the degree of computer implementation among teachers in Malaysia. Teachers who were reported with high self-reported knowledge, and positive attitudes and concerns integrate information and learning

technology in the teaching process. Hong and Koh (2002) revealed that rural secondary school teachers in Malaysia have low computer anxiety levels and positive attitudes toward computers. As more information and learning technology is deployed in career and technical institutions in Malaysia, it is important to understand its diffusion among educators.

Statement of the Problem

Rogers (2003) noticed that the diffusion of many innovations requires a period of several years from the time when is first available to when it is widely adopted. In Malaysia, the government has emphasized information and learning technology and financially supports its usage as a step to prepare the knowledge worker in the knowledge economy. The usage of information and learning technology among career and technical educators in Malaysia has given rise to concerns regarding its diffusion in teaching practices. This is particularly important in the expansion of information and learning technology in the career and technical institutions as Malaysian competitiveness to prepare knowledge workers has become apparent. The inquiry which arises, therefore, is to investigate the relationships of self-reported knowledge, barriers to use, institutional supports, user satisfaction, gender, years of teaching, personal computer ownership, and usage of information and learning technology in teaching practices in the career and technical education system in Malaysia

Purpose of the Study

The purpose of this study is to describe the relationships of self-reported knowledge, barriers to use, institutional supports, user satisfaction, gender, years of teaching, personal computer ownership, and usage of information and learning

technology among career and technical educators in Malaysia. It is hoped that the findings of the study will provide a direction to the career and technical education system policy makers, educators, and institutions in Malaysia on how to enhance the diffusion of information and learning technology in the teaching process for the benefits of both educators and students.

Research Questions

The following research questions were formulated to determine the diffusion of information and learning technology among career and technical educators in Malaysia:

1. How can the self-reported data from the survey be described?
    a. How can the participants be described?
    b. How can participants' responses to the major constructs be described?

2a. Is there a difference between genders on ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?

2b. Is there a difference between participants who own computer and those who do not on their ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?

2c. Is there an interaction between gender and personal computer ownership on ratings on self-reported knowledge, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports?

3. Are there associations among self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, gender, years of teaching, and personal computer ownership?
4. Is there a combination of gender, years of teaching, personal computer ownership, self-reported knowledge, user satisfaction, barriers to use, and institutional supports that predicts the usage of information and learning technology in the teaching process better than any variable alone?
5. Is there a combination of gender, years of teaching, personal computer ownership, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports that predicts the self-reported knowledge of information and learning technology better than any variable alone?

Definition of Terms

Career and technical educators — Individuals who have a qualification to teach and organize educational activities that:

i. offer a sequence of courses that provide individuals with the academic and technical knowledge and skills they need to prepare for further education and for careers (other than careers requiring a baccalaureate, master's, or doctoral degree) in current or emerging employment sectors;

ii. includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and occupational specific skills of an individual.

Information and learning technology	In this study, the term refers to the products of technology including devices, system processes, and environments for the purposes of enhancing teaching and learning processes as well as the management of the learning environment.
Diffusion	Rogers (2003) defined this as the process by which an innovation is communicated through certain channels over time among the members of the social system. In this study, diffusion refers to the usage and self-reported knowledge of information and learning technology in teaching process among career and technical educators in Malaysia.
Usage of information and learning technology	The frequency to which a career and technical educators integrate and use information and learning technology as tools to support teaching and learning processes.
Self reported knowledge	An individual's comfort level of knowledge in using various types of information and learning technology in the process and management of teaching and learning to accomplish and enhance the learning environment, course content, and tasks..

User satisfaction	Career and technical educators overall effective gratification regarding their experience related to the usage of information and learning technology as teaching tools.
Institutional support	Institutional responses to overcome or reduce problems in timely manner fashion to create positive attitudes and behaviors to use information and learning technology.
Barriers to use	A constraint or reluctance to integrate and apply information and learning technology in the instructional activities.
Soft skills	Interpersonal skills that provide the capacity for smooth running human relations and job performance including the ability to communicate effectively, teamwork, problem solving, time management, analysis, creativity, flexibility, and adaptability (Aspen Institute, 2002; Carnevale & Desrochers, 2003).
Personal computer (PC) ownership	This term are used to indicate a computer possession in a faculty member's residence that contains a microprocessor, an operating system, and a keyboard or mouse device including notebook (laptop) but does not include possession in the office. In Malaysia, most of faculty members have computer in their office provided by the institutions.

Delimitations

This study was delimited to participants from a 2005 database of instructors at the Center for Instructor and Advanced Skill Training in Malaysia. The study did not include other career and technical institutions in Malaysia. Further, the sample was delimited by

a specific program of study offered by the Center. There were 10 programs included in the study. Therefore, the study will not be generalizable to all areas of career and technical programs in Malaysia.

The study also was delimited to the items of the questionnaire. The questionnaire was not designed to identify specific products of information and learning technology, authoring programs, programming languages, manufacturer or training programs. The variables in this study includes self–reported knowledge, user satisfaction, institutional supports, barriers to use, personal computer ownership, years of teaching, gender, and usage of information and learning technology.

Significance of the Study

The ability to utilize information and communication technology has become a form of new literacy for the knowledge economy. It is critically important to prepare knowledge-workers and utilize the information superhighway for enabling Malaysia to successfully compete in the global community. The rapid increase in the adoption of information and communication technology in delivering instruction in the Malaysian career and technical system requires careful investigation of the use of information and learning technology.

A study by Mukti (2000), which analyzed teachers' background characteristics, attitudes, and concerns related to use of technology in Malaysia, found a significant relation in the degree of classroom computer usage and these characteristics. Knowledge of instructional strategies used for technical education is crucial in ensuring an effective and efficient instructional process. This study will provide relevant information to

enhance and engage educators at career and technical institutions in Malaysia using information and learning technology appropriately for teaching purposes.

The Malaysian government has spent a large amount of funding to provide information and learning technology infrastructure and tools to career and technical institutions. Since the information and learning technology exists and is emerging, career and technical education students will wonder why they are shown outdated modes of teaching processes.

Researcher's Perspective

This research, titled "Diffusion of Information and Learning Technology among Career and Technical Educators in Malaysia", investigates the adoption of technologies in teaching practices in Malaysia. My interest grew and became more focused on the adoption of the technology by examining evolution of each new innovation.

I believed that technology does not necessarily make people think better, but it most assuredly makes people think differently. I believe that technologies can be utilized in the support of inquiry based learning. For instance, the technology assists teacher delivery of content in a brief time through carefully crafted exercises or presentations which leaves more time for student-teacher interactions or questions. My experience and work environment have caused me to question the use and adoption of information and learning technology among career and technical teacher in Malaysia. Especially when I reflect upon use of their innovations in Malaysia compared to the use of similar innovations in the United States.

Currently, I am on leave from Malaysia to further my study for a doctoral of philosophy degree at Colorado State University. I worked at a public university in

Malaysia, Universiti Putra Malaysia. Previously, I taught at one technical high school for approximately 12 years. I am a faculty member in the Department of Science and Technical Education in the Faculty of Educational Studies. I am responsible for teaching, evaluating, and maintaining the career and technical education programs that are offered to students. The school awards baccalaureate, master's, and doctor of philosophy degrees in career and technical education. Graduating students from this university will be teaching at various public and private institutions. This research is a stepping stone that will lead me to a better understanding of technical instructional issues related to teaching and learning as well as workplace changes in career and technical institutions.

CHAPTER 2: LITERATURE REVIEW

Introduction

This chapter presents a review of the literature and related research on diffusion of information and learning technology. This literature review comprised of the seven sections including summary. The sections are: 1) information and learning technology, 2) information and learning technology in Malaysia, 3) diffusion of information and learning technology, 4) change management, 5) change management and diffusion of information and learning technology, 6) career and technical education in Malaysia, and 7) summary.

Information and Learning Technology

Research findings show information and learning technology can be used to increase and affect student learning (Graves & Twigg, 2006; Lynch, 2002; Pflaum, 2004; Viadero, 2004). Research has been conducted about diffusion of information technology in several education settings (Bennett & Bennett, 2003; Groves & Zemel, 2000; Moerch, 1995; Spotts & Bowman, 1995). The research about how teachers adopt the information and learning technology and use it to enrich teaching and learning process is still ongoing. *The Chronicle Review of Higher Education* (2004) stated that the last 10 years focused on equip technology to the campus. They also predicted the next 10 years will be about making technology more effective, easier to use, and easier to manage. The study is designed to provide a direction to policy makers, educators, and institutions of

career and technical education in Malaysia on how to enhance information and learning technology in the teaching process for benefits both the educators and the students.

Technology has always had impacts on society. For instance, the invention of the printing press had a massive impact on society. Information and communication technology offers remarkable promise of having an impact on every aspect of society. Research findings confirm information and learning technology has a potential for enhancing teaching and learning processes. It can speed and simplify performance of routine tasks instead of putting pressure on teachers to deliver content in brief time periods, which leaves little time for questions. Using information and learning technology will increase time for teacher interaction and exploration of subjects in depth (Alessi & Trollip, 2001; Chin, 2004).

Information and learning technology can be employed to support general learning activities that have been shown to be successful through research specifically presenting information, guiding the learner, practicing, and assessing learning (Alessi & Trollip, 2001). These four activities can be used in a number of ways including lectures, tutorials, drill and practice exercises, group exercises, or open ended tasks (Chin, 2004). For instance, information and learning technology can be employed to deliver content as formal lecture but with carefully crafted exercises like practice activities, it can provide better guidance and understanding of topics. Consequently, understanding the diffusion of information and learning technology can lead to the development of effective strategies for planning and managing that career and technical educators want and can successfully use in the teaching practices.

The U.S. Department of Education concluded in their analysis of mathematic programs across the nation that students actually learned more with a computer based algebra programs than traditional learning style (Viadero, 2004). Information and learning technology seemed to revolutionize education. However Pflaum (2001) found out that the roles that information and learning technology currently play in the classroom are not truly beneficial to students and educators. Findings from Hogan (2005) reported that students who used traditional instruction had higher grades than student who used CAI. Furthermore, Spector and Anderson (2000) stated that there has been a trend in applying information and learning technology to support teaching and learning in ever more challenging and complex domains.

Morrison and Osborn (2005) stated that the reasons for information and learning technology not become lasting in education organizations are also complex, but they point out the root cause is an incompatibility between the way the educational system is organized and innovation itself. To illustrate this problem, they stated that the educational system is highly mechanistic, with top down decisions, no merit pay, and rote learning. All of which contributes to an incompatibility with the many innovations necessary to bring education into the new knowledge economy. In addition, problems such as educators' lack of self-reported knowledge or proficiency with information and learning technology, difficult in use the system and lack of institutional supports contribute to frustrations to integrate and implement in the teaching process. Findings from Butler and Sellbom (2002) showed lack of institutional support, lack of financial support, and lack of time to learn new technologies were three factors that imposed barriers to adoption of information and learning technology.

Information and Learning Technology in Malaysia

In this knowledge economy, Malaysia as a developing country, faces new challenges to continuously sustain the sources of competitiveness in order to access global market and technology (Ministry of Education, 1997). These challenges are a result of the new economy and the rapid growth of technology. Malaysia was predominantly an agricultural economy under British colonial rule prior to 1957. After independence, industrialization became a very important strategy for economic development.

In the new economy, knowledge is the only resource capable of dealing with continually and unpredictable changes. Malaysia competitiveness depends on utilizing the information and effectively allocates the scarce knowledge resources that are available. Drucker (1998, 2003) emphasized in the 21st century that the resources that have historically sustained competitive advantage in business will no longer be viable in maintaining that competitive advantage in the future. The edge that developed countries will have will be the productivity and knowledge workers. Drucker (2003) stated productivity of knowledge workers will be the decisive factor for survival in knowledge economy. A knowledge worker is defined as someone who adds value by processing existing information to create new information which could be used to define and solve problems (Drucker, 1998). Development in the educational system is the indicators of overall initiatives by the nation (Bajunid, 2001).

Bajunid (2001) identifies the efforts of Malaysian educational system in transforming itself through technological advantages in four phases. In the first phase, from 1957 to 1967, educational development focused on the expansion of the physical

infrastructure, the building of the schools and the training of teachers. The second phase was from 1967 to 1976. During this time period, teaching and learning materials were largely print-based with various kinds of teaching aids. Early adoption of information and learning technology in Malaysia included the Examination Syndicate and higher education level institutions. At the higher education level, research data were analyzed using computer cards fed into mainframe or mini-frame computers and the Examination Syndicate became one of the first government agencies to own and use mainframe computers.

The third phase was from 1976 to 1986. This time period saw the overlapping of traditional methods and the use of new technology. For instance, personal computers began to replace the typewriter and the photocopying machine replaced the cyclostyle (ditto) machine.

The fourth phase was from 1986 through the mid 1990s. This phase saw the widespread use of new technologies, particularly the computer in the teaching and learning process. Educators began to discuss the various teaching models in the use of computer in education. The Ministry of Education introduced various programs meant to help teachers transform their teaching process with information and learning technology. Programs like Introduction to Computers (1986), National System of Educational Databases (1989), Computer Literacy Project (1992), Educational Resource Centers (1993), Computer Aided Instruction (1994), Educational Network Project (1994), Computer in Education Project (1994), Munsyi Network Project (1994), and Educational Management Information System (1995) were introduced and helped increase computer awareness throughout the country.

The Computer Literacy Project which initially covered 20 primary schools was expanded to cover an additional 240 primary schools in 2000. This project benefits 104,000 students. The government also encouraged the private sector and individuals to support this project by donating personal computers as well as computer aided teaching and learning materials to rural schools.

The final stage was from the early 1990s to the present. In this phase, efforts are being made to fully utilize information and communication technology in transforming the Malaysian society into knowledge based society. The Malaysian plan is to obtain the status of an industrialized nation by the year 2020 and to gain a competitive edge over other developing countries in the knowledge based economy. Through Vision 2020, Malaysia responded to the technological challenge with seven flagship applications and four initiatives of major government-driven mega programs. Those initiatives are the Multimedia Super Corridor, the National Information Technology Council, the K-Economy Master Plan, and the Skilled Human Resource Development Plan. Due to increased demand for knowledge for workers in the knowledge economy, smart school programs were adopted as one of the seven flagship applications of Vision 2020.

Findings from Mukti (2000) showed that teacher background characteristics, attitudes, and concerns have a significant relationship to the degree of computer implementation among teachers in Malaysia. A study by Hong and Koh (2002) revealed that rural secondary school teachers in Malaysia have low computer anxiety levels and positive attitudes toward computers.

Diffusion of Information and Learning Technology

Innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 2003). In this study, the innovation is adoption of information and learning technology as teaching tools among career and technical educators. Many innovations require a period of several years from the available time until they are widely adopted (Rogers, 2003). According to Morrison and Osborn (2005), innovative organizations and systems share a different, organic structure; like an organism made up of collaborative and competitive parts.

The decision to adopt or reject the innovation is called the innovation-decision process. Rogers (2003) defines the process through which an individual passes is from a) gaining initial knowledge of an innovation, b) to forming an attitude toward the innovation, c) to making a decision to adopt or reject, d) to implementation of the new idea, and e) to confirm this decision.

The Innovation-Decision Process Model

The individuals in a social system adopt an innovation in an over-time sequence and can be classified as innovators, early adopters, early majority, late majority and laggards (Rogers, 2003). The factors that influenced the individuals to adopt the innovation included socioeconomic status, personality values, and communication behavior (Rogers, 2003). Rogers (2003) noted that process of adoption consists of a series of choices and action over time through which an individual or a system evaluates a new idea and decides to adopt or reject the innovation.

Rogers (2003) presented the five stages model of the innovation-decision process. The model, dealing with uncertainty in decision making, consists of five stages as

knowledge, persuasion, decision, implementation, and confirmation. Figure 2 illustrated the model of innovation-decision process.

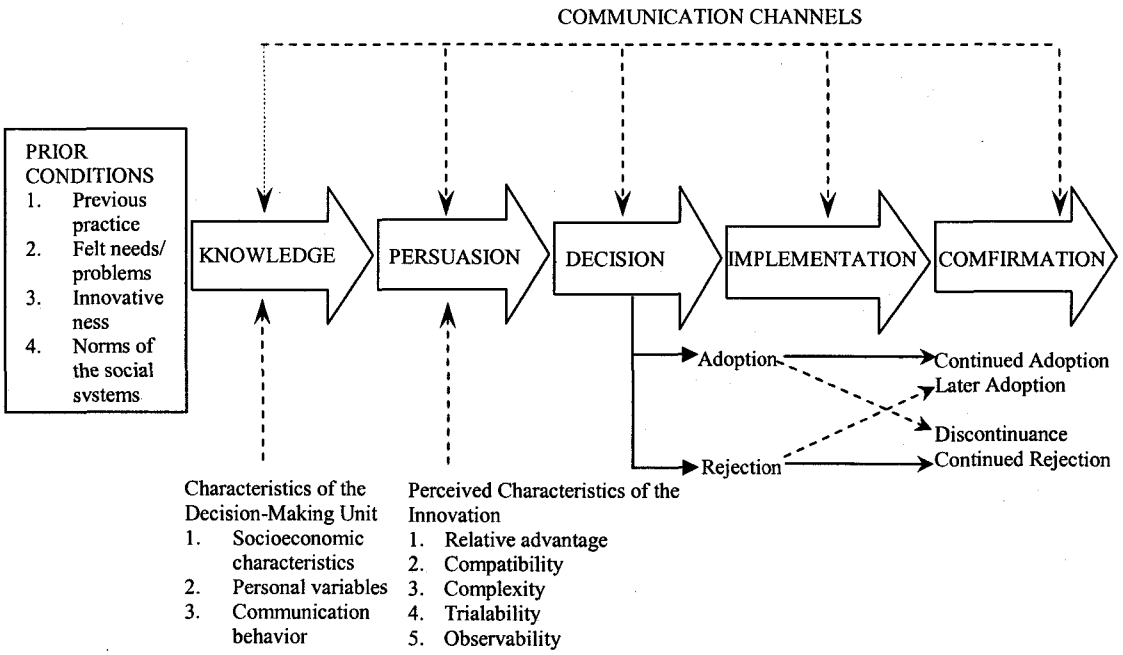

Figure 2. A model of five stages in the innovative-decision process by E. M. Rogers, 2003, Diffusion of Innovations (5th ed.), 170.

The knowledge stage is the first step in the model after prior conditions in the decision processes. The knowledge stage occurs when an individual is exposed to an innovation's existence and gains an understanding of how it functions. In this stage, an individual is motivated to reduce uncertainty with three types of knowledge about an innovation includes awareness-knowledge, how-to knowledge, and principles-knowledge. The awareness-knowledge is an individual who has information that an innovation exists. The how-to knowledge consists of information necessary to use an innovation properly. The principles-knowledge consists of information dealing with functional principles underlying how an innovation works.

The second stage is persuasion. It occur when an individual forms a favorable or an unfavorable attitude towards the innovation. The individual becomes more psychologically involved with the innovation whereas the mental activity was mainly cognitive or knowing and the thinking type was affective or feeling. The third stage is called the decision stage. It takes place when an individual engages in activities that lead to a choice to adopt or reject an innovation. The implementation stage is the next stage in the model. It occurs when an individual puts an innovation to use. This stage involves overt behavior change in regard to the previous stages. The final stage of this model is the confirmation stage. In this stage, the individual or decision making unit seeks reinforcement for the innovation-decision already made, and may reverse this decision if exposed to conflicting messages about the innovation. Rogers (2003) noticed that at this stage, the individual seeks to avoid a state of dissonance or reduce it. Dissonance is a result of human behavior change that often motivates an uncomfortable state of mind.

Rogers (2003) stated that the diffusion of innovation influenced several characteristics of the technology. These characteristics include relative advantage, compatibility, complexity, trialability, and observability. Past research showed that the change processes that are perceived by individuals as having greater relative advantage, compatibility, trialability, obervability, and less complexity will be adopted more rapidly (Rogers, 2003).

Relative advantage, the first characteristic, is the degree to which the individual perceives a new technology as superior to existing substitutes. Rogers (2003) suggested this characteristic can be measured by factors such as economic terms, social prestige, convenience, and satisfaction. The second characteristic is compatibility. Rogers (2003)

defines compatibility as the degree to which the innovation is perceived as being consistent with the existing values, past experiences, and need of potential adopters. Complexity is the third characteristics of innovations. It means the degree to which an innovation is perceived as difficult to understand and use (Rogers, 2003). The fourth characteristic is trialability. It is defined as the degree to which an innovation may be experimented with on a limited basis (Rogers, 2003). The final characteristic is observability. Rogers (2003) defines observability as the degree to which the results of an innovation are visible to others.

Organic Education

This term was created and uses by Gayle and Morrison to denote a form of education based on the 21st century organic principles (Morrison & Osborn, 2005). In organic education, there are three organization levels including: 1) the student-teacher interface in the classroom, 2) the district level where local budget and policy decisions are made, and 3) the state/national level where politicians define dictate that lead to red tape.

The idea of organic education is a bottom up scenario in which organic forces replace existing mechanistic approaches at all three levels. Through empowering and connect the system among organization, the results of organic education is extraordinary (Morrison & Osborn, 2005). If faculty members are empowering with responsibility and tools and connect them in collaborative structures, the results are applicable and powerful enough to spark a transformation in education system.

According to Morrison and Osborn (2005), organic education places virtually all the major problems and issues in education organization with acts as an instrument to

force transformation of the education system. They suggest that organic education can be implemented through applying organic principles at the three organization level: classroom, district and national. Through organic education, they believed that human beings are wired to learn to follow the small organic group model that has been so successful in corporations, team gaming, and the military. It is also seen in its natural form in student's imaginative play groups: motivated in groups but often learning and working individually, intertwining productive work with learning and play (Morrison & Osborn, 2005).

Change Management

Profound changes are constantly taking place that deal with information and communication technology, or common changes concerning reorganization, working condition, personnel policies, or philosophies of management. These changes take place through innovation, invention, government, automation, and other means aimed to make improvement of better productivity. Change is difficult to manage because it is associated with uncertainties and doubts and often is accompanied by chaotic processes (Krayer & Lee, 2003).

There are many difficulties or resentments to profound change. Senge, Ross, Smith, Roberts, & Kleiner (1994, 1999) stated that the challenges of initiating change develops as soon as any pilot group begins to conduct its work in an unfamiliar way. Jaffe and Scott (1999) noticed that change efforts have not achieved the expected results because individuals do not participate in the process. Levels of change in organization were categorized as knowledge changes, attitudinal changes, behavior changes, and group or organizational performance changes (Blanchard & Hersey, 1996). Change in

the knowledge tends to be easiest to initiate compared to implementing change in group or organizational performance.

Krayer and Lee (2003) believed that people resist profound change for four basic reasons: 1) lack of involvement in the process, 2) lack of knowledge about the change, 3) insecurity about the future as a result of the change, and 4) feelings of powerlessness to control their own destiny. Kirkpatrick (1996) noticed that people react negatively to change because of several reasons including personal loss, more harm than good, lack of respect, objectionable manner, negative attitude, no input, personal criticism, create burdens, bad timing, and secondhand information. Senge et al. (1999) described ten challenges and difficulties of initiating changes as follows:

1) The challenge of control over one's time. People involved in change initiatives need enough flexibility to devote time to reflection and practice.
2) The challenge of inadequate coaching, guidance and support for innovating groups, and ultimately developing internal resources for building capacity.
3) The challenge of relevance. Making a case for change, articulating an appropriate organization focus, and showing why new efforts, such as developing learning capabilities are relevant to organization goals.
4) The challenge of management. Clarity and consistency, the mismatch between behavior and espoused values, especially in those championing change.
5) The challenge of fear and anxiety. Concerns about exposure, vulnerability, and inadequacy, triggered by the conflict between increasing

levels of candor and openness and low levels of trust among pilot group members.

6) The challenge of negative assessment of progress. Disconnection between the organization's traditional ways of measuring success and the achievements of a pilot group.
7) The challenge of isolation and arrogance, which appears when the true believers within the pilot groups confront their nonbeliever counterparts outside the group. As a result, the pilot group and the rest of organizational system consistently misinterpret each other.
8) The challenge of prevailing governance structure, and the conflicts between pilot group seeking greater autonomy and managers concerned about autonomy leading to chaos and internal fragmentation.
9) The challenge of diffusion, the inability to transfer knowledge across organizational boundaries, making it difficult for people around the system to build on each other's successes.
10) The challenge of organizational strategy and purpose. Revitalizing and rethinking the origination's intended business focus, its contribution to its community, and its identity.

Clearly, difficulty in implementing change is not a modern concept. It seems to have endured through the ages, in part because humans are biologically hard-wired to resist change (Black & Gregerson, 2002). Change has always been and remains difficult. Initiating changes require change agents like managers or institutional leaders to carefully

consider steps of how to get the people who are affected like employees or teams to accept the changes.

Individuals react differently to the change process. People's resistance and acceptance of change, depends on their personal experiences. The degree to which these responses occur depends on many factors. Kirkpatrick (1996) stated some of the reasons people accept changes are: personal gain, to provide a new challenge, to respects the source or change agent, reduce boredom, provide input, desire change, improve their future, and the right time.

The process of a change takes place within a setting of a social system like an organization. The social system has a marked effect on the behavior of the individual. For instance, usually faculty members have typically not been involved in decisions regarding the acquisition of administrative or instructional technologies. Research findings by Rice and Miller (2001) indicated that faculty members need to be involved in structural initiatives related to the process of planning for the use of technology, a better identification of who should be involved in technology planning and decision making and the general decision making process. Ignoring the effect of both the individual and the social system often leads to failure of implementing change.

Change Management and Diffusion of Information and Learning Technology

Information and communication technology systems have permeated virtually every facet of lives and organizations, creating a demand for individuals with its skills at every level. Technical skills alone are not sufficient for success in the information and communication technology profession. Soft skills like communication, problem solving, and teamwork are increasingly important in the new economy. Successful development

of programs for information and learning technology integration can lay the foundation for systematic and sustainable changes in career and technical institutions. Kershaw (1996) believed successful technology integration focuses on managing change effectively.

Change in organizations must be managed and directed. People do not automatically adopt something new even if it is an obvious benefit. Change agents usually actively involve all phases of the change initiative (Black & Gregerson, 2002; Fullan, 2001; Lientz & Rea, 2004; Senge et al., 1994; Senge et al., 1999). Change agents permeate all facets of an organization undertaking the initiative (Krayer & Lee, 2003). In addition, the more organized a change initiative is, the more the organization can maintain productivity and benefit itself.

Diffusion and Information and Learning Technology Integrated Model

Sherry, Billig, Tavalin, & Gibson (2002) developed and validated Integrated Technology Adoption and Diffusion Model. This model was a research-based model. They found that teachers generally go through four distinct stages as they develop expertise with the information and learning technology. The model describes a cyclic process in which teachers evolve from learners to adopters of information and learning technology, then to co-learners or co-explorers with their students, and finally to a reaffirmation or reject decision. Figure 3 illustrated the Integrated Technology Adoption and Diffusion Model.

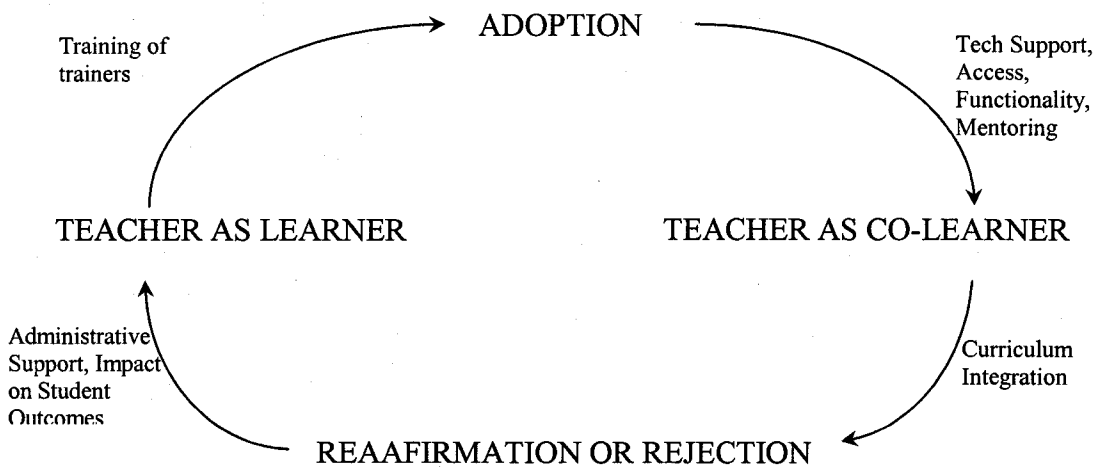

Figure 3. An integrated technology adoption and diffusion model

The Integrated Technology Adoption and Diffusion Model have five stages. The first stage is teacher as learner. In this stage, teacher gathering information and learn the knowledge and skills necessary for performing instructional tasks using technology. Rogers (2003) stated that the rate of adoption usually starts low, accelerates until about 50 percent of the community has adopted the technology, then decelerates, eventually approaching zero, as nearly everyone in the community has adopted the technology. Sherry et al. (2002) suggested effective strategies for this stage includes time for training, demonstrations of promising practices, ongoing professional development by peers rather than one-shot workshops by outside experts, in-service sessions that stress the alignment of technology with curriculum standards.

The second stage is called teacher as adopter. In this stage, the teacher progresses through stages of personal and task management concern as they experiment with the technology begin to try it out in their classrooms, and share their experiences with their

peers. They suggested online resources, help desks, and other forms of reality accessible technical support, mechanisms to deal with technical problems as they arise, in-building technical specialists, other technology-savvy teacher who can mentor new users, provide them with care and comfort as well as information, and open lab workshops at school sites to solve specific technical problems.

The third stage is called teacher as co-learner. In this stage, teachers focus on developing a clear relationship between technology and the curriculum, rather than concentrating on task management aspects. Sherry et al. (2002) recommended activities such as workshops and online resources with strategies for enhancing instruction and integrating technology into the curriculum, collegial sharing of standards integration, exemplary products and assessment ideas, use of students as informal technical assistants. The fourth stage is called teacher as reaffirmer or rejecter. In this stage, teachers develop or greater awareness of intermediate learning outcomes. They begin to create new ways to observe and assess impact on student products and performances, and to disseminate exemplary student work to a larger audience. Effective strategies for this stage included administrative support, an incentive system that is valued by adopting teachers, awareness of intermediate learning outcomes such as increased time on task, lower absenteeism, student engagement, and increased metacognitive skills, evidence of impact on student products and performances, and dissemination of exemplary student work.

The final stage is called teacher as leader. In this stage, experienced teachers expand their roles to become active researchers who carefully observe their practice, collect data, share the improvements in practice with peers, and new members. Their skills become portable. Sherry et al. (2002) suggested effective strategies for this stage is

give incentives for co-teaching on-site workshops, release time and other semi-permanent role changes to allow peer coaching and outside consulting, support from an outside network of teacher-leaders, structured time for leading in-house discussions and workshops, and transfer of skills if teacher goes to another school.

Findings from Bennett and Bennet (2003) support the Integrated Technology Adoption and Diffusion Model. Bennett and Bennett (2003) noticed that factors that influence the diffusion of innovation included: 1) discuss relative advantages of information and learning technology, 2) offer demonstrations of how the technology can be utilized to enhance teaching and learning, 3) provide opportunity to test drive the technology, 4) consider the participant level comfort with technology, and 5) show how the technology fits with the participants' philosophies of teaching. Findings from Wilson (2003) revealed several conclusions included: 1) faculty provided with information and learning technology use them extensively, 2) faculty who teach distance learning are more likely to use information and learning technology than who teach in campus, 3) faculty learn about technology primarily through self-help, not from institutional supports or sources, 4) for faculty, some campus resources are more useful than others, and 5) internal incentives have most significant impact on faculty.

Chizmar and Williams (2001) offered six recommendations in their survey of faculty needs and attitudes for instructional technology. The recommendations included: 1) institutional should provide a selection of web-based instructional technology modules that driven and tied to a specific pedagogical strategy, 2) instructional technology units should invest efforts in discrete solutions that are mapped to instructional needs and strategies, 3) instructional technology units should invest less efforts in solving the

technical problems of individual faculty members and more serving the faculty in general by creating series of modules or templates, 4) campuses need to create venues for faculty to come together to share and trade experiences, development efforts, templates, products, and the like, 5) administrations charged with providing instructional technology leadership must always guard against showing technology to become dominant, and 6) faculty need rewards for their instructional development efforts through release time, monetary rewards, software and hardware supports, and credit in salary, promotion, and tenure process.

There is ample evidence that information and learning technology can make instruction effective, efficient, exciting, satisfying, and rewarding. These potential benefits however, depend upon the availability of quality software, its integration into curriculum, and the setting in which it is offered (Bennet &Bennett, 2003; Chin, 2003; Chizmar & Williams, 2001; Hill, 2003; Wilson, 2003). Some of the variables examined by the researcher include self-reported knowledge, barriers to use, user satisfaction, institutional supports, usage of information and learning technology, gender, years of teaching, and personal computer ownership. Each of these variables were summarized below.

Self-reported Knowledge

Self-reported knowledge is one of the variables that usually facilitate the adoption of information and learning technology. Spotts and Bowman (1995) used self-reported knowledge to differentiate theoretical knowledge from actual application. Groves and Zemel (2000) described that faculty members may take advantage of information and learning technology to relate more content more closely to practice and to provide

opportunities for knowledge application. Butler and Sellbom (2002) noted in their findings that faculty varied widely in technology proficiency.

Barriers to Use

Findings from Butler and Sellbom (2002) revealed that faculty members reported the most common problem with using the information and learning technology includes equipment failure or malfunction, time to learn new technology, weak campus support, and software that out of date. These barriers are identified both by faculty with high and low levels of self-reported knowledge of information and learning technology. Leggett and Persichitte (1998) and Rogers (2000) identified five categories of barriers using information and learning technology comprise of time, expertise, access, resources, and support.

Usage of Information and Learning Technology

Usage of information and learning technology was used to assess current adoption of innovation (Groves & Zemel, 2000). They noticed that faculty members often feel unprepared for the demands of using technology in their teaching because they had little instruction in how to use it.

Institutional Supports

Institutional supports describe characteristics of institutions. Research findings showed institutional supports constrain or facilitate the adoption of information and learning technology. Butler and Sellbom (2002) revealed that faculty members had concerns about inadequate institutional support in their efforts in usage of information and learning technology.

User Satisfaction

User satisfaction reflects the interaction of information technology with the users and is frequently used as a variable for evaluating information technology success (Igbaria & Tan, 1997). DeLone and McLean (1992) proposed those users who are more satisfied with the information technology will report a greater level of individual impact on job performance.

Gender

Spotts, Bowman, & Mertz (1997) summarized some of the current perspectives found in research include: 1) gender difference exist in equality of access to, and performance with technologies, differences that seem to favor males; 2) gender differences exist in the ways that women and men learn to use technologies; 3) gender differences exist in attitudes and anxieties about technology, difference that result from culture and personal experience; and 4) little if any evidence supports the existence of gender differences in attitudes toward technologies. They noticed that only a few have addressed potential gender differences related to faculty use of and attitudes toward instructional technology in higher education. Venkatesh and Morris (2000) stated that men are more influenced by perceptions of usefulness of the product and women are more influenced by their perception of how easy the technology is to use.

Years of Teaching Experience

Kagima and Hausafus (2000) revealed in their research findings faculty members who have ten or more years of teaching experience have lower capabilities using the information and learning technology.

Personal Computer Ownership

Spotts and Bowman (1995) addressed that there is a significant differences in comparing faculty members who own personal computer and those who not owning one. They suggested that those owning a personal computer have a greater familiarity with the technology and utilize them to a greater degree.

Career and Technical Education in Malaysia

Career and technical education is defined as those educational activities that: a) offer a sequence of courses that provides individuals with the academic and technical knowledge and skills they need to prepare for further education and for careers (other than for careers requiring a baccalaureate, master's, or doctoral degree) in current or emerging employment sectors; b) includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and occupational specific skills of an individual (Carl D. Perkins Vocational and Applied Technology Act of 1998).

Historically, formal career and technical education in Malaysia was introduced by the British in 1897 to train Malay youths as mechanics or fitters to manage the railway lines (Lourdesamy, 2000). However, it was not until 1906 when the first public technical school was opened to train technicians to work in various government departments that vocational training began to have an impact (Marzuki & Som, 1999). In 1926, the first trade school was opened in Kuala Lumpur, thus marking the beginning of public career and technical education in Malaysia.

A major change in the career and technical school system occurred in 1965 when the comprehensive education system was introduced. The new system, which rose the

school-leaving age to 15, was designed to change the form and content of secondary-level education by expanding and diversifying of the range of courses offered. Students received general education with a vocational or technical emphasis in industrial arts, agriculture science, commercial studies, and home sciences (Marzuki & Som, 1999). In 1987, a new career and technical school system was introduced. Under this system, career and technical students are given a choice: either to enroll in a vocational program or in a skills training program. In the vocational track, students are given emphasis on academic subjects with the purpose of providing them a better foundation should they decide to continue their higher education in technical colleges or polytechnic without affecting vocational skills development at the lower level. In the skills training track, students are given more time and emphasis on skills training and development as required by industry.

In 1996, the Ministry of Education made a dramatic shift to upgrade career and technical education, not only because of the requirements of the economy but also to increase more science and technical human resource (Economic Planning Unit, 2001; Ministry of Education, 1997). In this regard, 22 secondary vocational schools were converted into secondary technical schools for the 1996 session. In 2000, the conversion of secondary vocational schools to secondary technical schools was completed (Economic Planning Unit, 2001). This conversion expanded the technical stream in the career and technical education and at the same time maintained the vocational and skill streams previously offered in the secondary vocational schools to accommodate low achievers in the lower secondary examination.

The technical stream in secondary technical schools produced students with a strong foundation in technical and science subjects while the vocational and skill streams prepared students with the basic skills for employment. At the same time, engineering technology and technical drawing subjects were also introduced in selected academic secondary schools. The move was to open up opportunities for academic students who inclined to be in technical areas as well as to prepare them to continue their studies in various science and technical related disciplines at the post secondary level (Economic Planning Unit, 2001). Changes in technology increased the demand for multi-skilled manpower with strong academic foundations, knowledge capabilities, and extra-functional skills. With the development of knowledge based economy, the career and technical education focuses on knowledge and higher order thinking skills in addition to the technical skills.

The Malaysian government adopted the dual training approach through apprenticeship schemes. This approach is a combination of work-based training and attendance of part-time career and technical training. The focus is on hands-on training at the workplace whereas the career and technical institutions provides the theoretical foundation. Career and technical institutions were encouraged to adopt this approach in collaboration with industry to enhance the effectiveness of their training programs. By acquiring work-related experience, a school graduated with *Sijil Pelajaran Malaysia* can be trained to be a certified skilled worker to meet the needs of industries. As the trainees spend about two thirds of their time in the workplace, the utilization of training facilities in institutions will be lower, reducing expenditure on infrastructure. Efforts will be made

to restructure training programs in all public training institutions to use this approach, which is market-oriented and responsive to changes in technology and industries.

Today, skills training are undertaken by various public and private institutions. The Malaysian government through five ministries is responsible for carrying out pre-employment skills training. These ministries included the Ministry of Human Resources through the Manpower Department; the Ministry of Education, through its Technical Education Department; the Ministry of Entrepreneur Development; the Ministry of Agriculture; and the Ministry of Youth and Sports. The skills training institutions has absorptive capacity of training to meet the increasing and changing demand of industries for skilled manpower. In 2000, the output of skilled manpower from these institutions increased to 44,490 from 27,910 in 1995 (Economic Planning Unit, 2001).

The capacity of career and technical institutions expanded to meet the increasing and changing demand of industries such as the use of modern and high technology production methods and processes. Seven additional advanced skills career and technical training centers have built during the year of 2000. These institutions offer course in specialized trades such as mechatronics, industrial engineering technology, computer engineering technology, telecommunications engineering technology, avionics engineering, and multimedia development.

Public career and technical institutions can strengthen their delivery system by using information and learning technology, including a web-based learning system. The implementation of web-based learning is critical as public training institutions are experiencing a shortage of instructors (Economic Planning Unit, 2001). Web-based institutions could improve the cost-effectiveness of training in the long run. Web-based

learning can also be an effective means for lifelong learning and provide the environment for self-paced learning. To alleviate the continued shortage of instructors, the Centre for Instructor and Advanced Skills Training as a training provider expanded the National Instructor Training Program to include students with Malaysian Skill Certificate as a trainer.

Summary

Malaysia's capability and capacity in the management of new knowledge and technologies will be determined by the quality of its human resource in this rapid changes market and globalization. Education and training will be crucial factors in development human resource in preparing Malaysia for the knowledge based economy (Economic Planning Unit, 2001). It is also a factor of the Malaysian competitive in the new economy and ability to take advantage of the vast opportunities arising from the information and communication technology revolution. In addition, education and training will be crucial in the creation of knowledge manpower to develop information rich society that will make Malaysian vision as a developed nation by the year 2020.

The Malaysian government has taken efforts to accelerate the implementation of information and communication technology. Information and communication technology will have an impact in accelerating the nation's economic growth. Toward this end, the diffusion and usage of information and communication technology will be further expanded to facilitate the seven flagships of Vision 2020.

To ensure the effective implementation of information and communication programs, human resource development will be emphasized to provide adequate knowledge and skilled workers. Although most of information and communication

research has been completed in the computer science settings, the research indicates positive results when addressing the variable of user satisfaction, usage of system, barriers to use, institutional supports, and self-reported knowledge of information and communication technology. The review of the related literature also indicated that there is a rise in the use of computers in education. Very little diffusion research has been done in career and technical education system in Malaysia. Therefore, there is a need of a study to investigate the use of information and learning technology in Malaysia career and technical education system.

This study will develop a knowledge base that will have the power to provide direction to Malaysian education policy makers, teachers, and career and technical institutions in Malaysia. This study will also provide direction on how information and learning technology can be increased in the teaching process for the benefits both the educator and the learner.

CHAPTER 3: METHODOLOGY

This chapter presents the methodology of the study including research design and rationale, participants, sampling procedure, variables, instrumentation, validity and reliability, data collection procedure, and data analysis. The study is important in gaining an improved understanding of the diffusion of information and learning technology among career and technical educators in Malaysia. The study investigates the relationships of self-reported knowledge, user satisfaction, institutional supports, barriers to use, personal computer ownership, years of teaching, gender, and usage of information and learning technology among educators in Malaysia career and technical education system.

Research Design and Rationale

The researcher was motivated by a desire to explore the relationship between variables of the study. The predictor variables of the study include self-reported knowledge, user satisfaction, barriers to use, institutional supports, gender, years of teaching experience, and personal computer ownership. The outcome variables included usage of information and learning technology and self-reported knowledge. This study used non-experimental approaches that explore and investigate the description, associations, and differences of patterns of participants.

According to Gliner and Morgan (2000), non experimental approach is applied when the researcher studies patterns of individual differences in attributes of the participants and does not have control over the independent variables. Creswell (2002)

noted that this design is useful in identifying the type of association, explaining complex relationships of multiple factors that explain an outcome, and predicting an outcome from one or more predictor variables. This non-experimental approach does not lead to a causal relationship; rather it helps explain relationships between variables.

Background of Participants

Public career and technical education in Malaysia is administered by various government agencies. These agencies are from various ministries including the Ministry of Education, Ministry of Human Resources, Ministry of Entrepreneur Development, Ministry of Youth and Sports, and Ministry of Agriculture. For instance, the Ministry of Education offers career and technical education training through technical secondary schools, polytechnics, and community colleges; the Ministry of Human Resources offers career and technical education training through industrial training institute, advanced technology training center, the Japan-Malaysian Training Institute, and the Center for Instructor and Advanced Skills Training; and the Ministry of Entrepreneur Development offers career and technical education training through MARA Vocational Institute, the Malaysian Craft Institute, and transfer technology institute such as the German-Malaysian Institute, the Malaysian-France Institute, and the British-Malaysian Institute. In the private sector, pre-employment skills training is carried out by an even more diverse and broad spectrum of training providers, covering wide-ranging courses and qualifications.

Population

The theoretical or target population was career and technical educators from public institutions which offer career and technical programs in Malaysia. These educators taught various programs in career and technical field. Programs offered by public career and technical institutions were from different ministries including Ministry of Education, Ministry of Human Resources, Ministry of Youth and Sports, Ministry of Entrepreneur Development, and Ministry of Agriculture.

Accessible Populations

The researcher had an accessible population or sampling frame of educators at the Center for Instructor and Advanced Skills Training constrained by cost and time. The educator at the Center provides basic and advanced skill training for three different groups including educators of other public skill training institutions, fresh graduates from high school, and workers from private companies.

The Center has five departments and offers 10 types of career and technical programs. The departments include National Instructor Training Program, Instructor and Supervisor, Vocational Training and Research Development, Skill Development, and Training Management. The programs offered consist of automotive engineering technology, welding and fabrication technology, computer networking technology, electronic engineering technology, machinery technology, mechatronic engineering technology, production technology, quality assurance technology, computer system technology, and telecommunication engineering technology.

Sampling Procedures

The researcher used a convenience sampling method due to constraints by time and cost. There are several programs in career and technical education offered at the Center of Instructors and Advanced Skills Training. The researcher had permission of the director of the center to conduct the study and a gatekeeper was assigned in helping for data collection. The selected sample was all educators at the Center of Instructors and Advanced Skills Training.

The total number of educators listed in the database was 160 people with 58.13% of male and 41.88% of female faculty members. The Director of the Center assigned one senior staff as a gatekeeper in helping data collection. The questionnaire with cover letter was given to each participant through the gatekeeper. The participants returned the completed questionnaire to the gatekeeper. The participants were asked to respond within two weeks.

Measures

The study used an instrument that addressed information regarding self-reported knowledge, usage of information and learning technology, institutional supports, user satisfaction, barriers to use, personal computer ownership, years of teaching, and gender.

Scales of measurement in the questionnaire were nominal, ordinal, and interval. According to Morgan, Leech, Gloeckner, & Barrett (2004), the term nominal scale is used for three or more unordered categories; but a scale with two categories, either ordered or unordered, is called dichotomous; ordinal scale used for variables with three or more ordered levels, but the frequency distribution of the scores is not normally distributed; and the term interval or normal scale is used when there are many (at least

five) ordered levels or scores, with the frequency distribution of the scores being approximately normally distributed. Skewness was used to determine if the variables were normally distributed or not.

Variables

The purpose of the study was to explain the relationships between variables. The researcher gathered data on self-reported knowledge, user satisfaction, institutional supports, barriers to use, years of teaching, gender, personal computer ownership, usage of information and learning technology and self-reported knowledge. The predictors in the study were self-reported knowledge, user satisfaction, institutional supports, barriers to use, gender, years of teaching, and personal computer ownership. The dependent like variable includes usage of information and learning technology and self-reported knowledge.

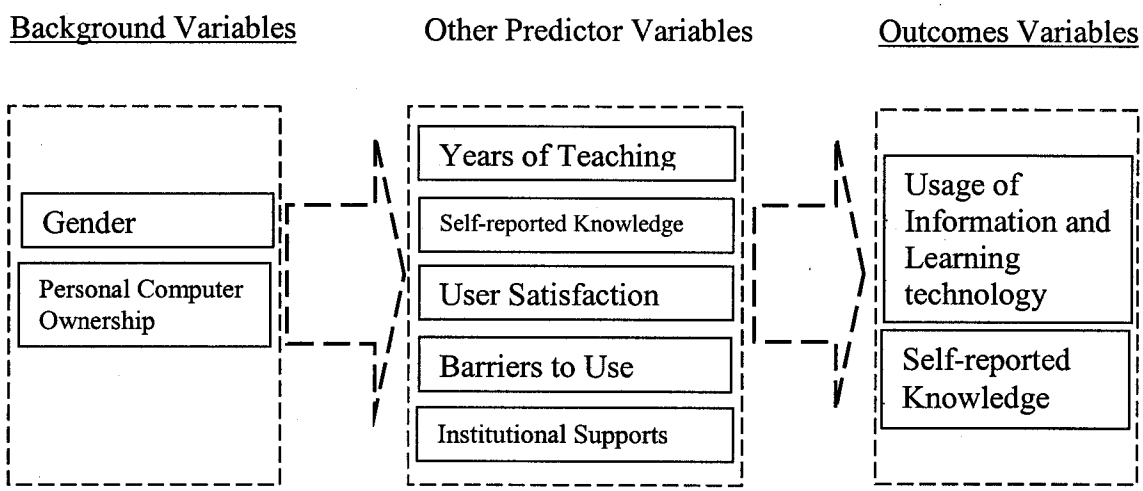

Figure 4. Factor model of adoption information and learning technology

Figure 4 illustrates the model of information and learning technology adoption in the study. Predictor variables included gender, years of teaching, personal computer

ownership, self-reported knowledge, user satisfaction, barriers to use, and institutional supports. Teacher attitude and learning style are intervening variables in this study. The outcome variables included the usage of information and learning technology and self-reported knowledge.

The types of research questions in the study were descriptive, associational, and difference. Morgan, Leech, Gloeckner, & Barrett (2004) stated the associational research question explains or predicts the association between the independent with the dependent variable; and difference research question compare groups derived from values of the independent variable on the scores of the outcome. Descriptive questions were used to describe or summarize self-reported data of the study. Table 2 summarizes the variables in the study.

Table 2

Variables and Items on the Questionnaire

Variable	Item on Questionnaire
Self-reported knowledge	Section A. Question 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13.
Usage of information and learning technology	Section B. Question 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16.
User satisfaction	Section C. Question 1, 2, 3, 4, 5, 6, 7, and 8.
Barriers to use	Section D. Questions 1, 2, 3, 4, 5, and 6.
Institutional supports	Section E. Question 1, 2, 3, 4, and 5.
Gender	Section F. Question 1.
Years of Teaching	Section F. Question 2.
Personal computer ownership	Section F. Question 3.

Instrumentation

Participants were requested to complete the questionnaire that included self-reported knowledge, user satisfaction, institutional supports, barriers to use, personal computer ownership, years of teaching, gender, and usage of information and learning technology in the study. The questionnaire were translated in Malay language by the researcher and validated by an expert in Malay language from Faculty of Educational Studies, Universiti Putra Malaysia.

The questionnaire consisted of six sections and 51 items that were adapted from an instrument originally developed and used by Spotts and Bowman (1995) and later used by Groves and Zemel (2000) to gather data to answer research questions in this study. Section A of the questionnaire included self-reported knowledge of information and learning technology. The variables were measured by 13 items. The responses to the questionnaire were based on the Likert scale with values of 0 to 4, with none = 0, a little = 1, moderate = 2, good = 3, and expert = 4 in the specific information and learning technology tools.

The usage of information and learning technology was measured by frequency of use in teaching from Section B. The items used a Likert scale on which participants were asked to indicate their use of 16 different practices as never = 0, 1 – 2 times per semester = 1, monthly = 2, weekly = 3, and almost every class = 4. In terms of user satisfaction, the questionnaire listed eight items in Section C, which were measured on the Likert scale with values of 1 to 5, with strongly dissatisfy = 1, dissatisfy = 2, satisfy = 3, very satisfy = 4, and strongly satisfy = 5.

Section D with six items measured barriers to use on Likert scale with not important = 1, somewhat important = 2, important = 3, very important = 4, and strongly important = 5. Section E measured institutional supports listed five items with Likert scale of not supportive = 1, somewhat supportive = 2, supportive = 3, very supportive = 4, and strongly supportive = 5. The final section was Section F of background information. The questions included gender, years of teaching experience, and personal computer ownership.

Pilot Test

A pilot test was conducted to test the direction of the items, comprehensives, average time taken to complete the questionnaire, and ease to filling it out. The pilot test was carried out by administering the questionnaire to 10 participants who were career and technical educators at the Advanced Skills Training Centre of Shah Alam, Malaysia.

The participants were comfortable with the time required to complete the questionnaire and its content. The reliability of the instrument was established using results from the pilot test. Cronbach alpha was used to measure internal consistency of reliability to determine interitem reliability. Gliner and Morgan (2000) suggested using Cronbach alpha if items on the questionnaire have multiple choices such as a Likert scale. Cronbach's alpha reliability of the overall items was .902. Cronbach's alpha for self-reported knowledge was .704, usage of information and learning technology was .871, user satisfaction was .850, barriers to use was .634, and institutional supports was .543.

Validity and Reliability

Fifty one items of the questionnaire were adapted from the survey originally developed and used by Spotts and Bowman (1995) and later used by Groves and Zemel (2000). Both of the previous questionnaires were reviewed for content validity by the committee members. To establish content validity for this questionnaire, a draft was reviewed and suggestions for revision were made by the dissertation committee members. The suggestions from committee members were used to revise the questionnaire.

Once again, the researcher ran Cronbach alpha of the 123 surveys returned to measure internal consistency reliability of the instrument. Cronbach alpha for overall items was .952. Cronbach's alpha for each variable as follows: 1) Self-reported knowledge, .915; 2) Usage, .898; 3) Satisfaction, .926; 4) Barrier, .813; and 5) Institutional support, .887. In addition, it appears that the average age and percent gender of faculty members at the center is similar to faculty members at other career and technical institutions in Malaysia.

Data Collection Procedures

Data for the study were gathered by means of a questionnaire administered to educators of the Center of Instructor and Advanced Skills Training in Malaysia. The Center was established in 1984 with collaboration between the Malaysian and the Japanese government under ASEAN Human Resources Development Project. The center was administered by the Ministry of Human Resources. The center offers training in various career and technical programs. The center provides and trains individuals to be instructors, supervisors, instructors of upgrading skills, and skilled workers from public and private sectors.

Initially, the researcher obtained a required approval from the Center of Instructor and Advanced Skills Training in Malaysia to enter a site and conduct a study (see Attachment E). Then, the researcher completed a H100 form to request approval from the Human Subject Committee of Regulatory Compliance Office at Colorado State University to conduct a study (see Attachment F). Approval was granted on October 3, 2005.

The instrument was translated to the Malays language by the researcher. Later, the instrument was validated by an expert in Malay language from Faculty of Educational Studies, Universiti Putra Malaysia. An instrument was distributed through the gatekeeper to each of the 160 participants. The participants returned the completed questionnaire to the gatekeeper. A cover letter accompanied a questionnaire stated the nature and purpose of the study (see Appendix A). It was co-signed by the dissertation adviser, Gene W. Gloeckner, PhD. Participants in the study were volunteers, and were assured confidentiality. The Head of Director of Human Resources Department and the Director of CIAST strongly supported the study.

Data Analysis

Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics were used to provide baseline data about background information of the participants. The descriptive statistics included central tendencies, percentages, and frequency distributions to summarize the data. Table 3 summarizes the research questions, variables, and statistical analysis of the study.

Table 3

Research Questions and Statistical Analysis

Research Question and Sub Questions	Statistical Analysis
1. How can the self-reported data from the survey be described? a. How can the participants be described? b. How can participants' responses to the major constructs be described?	Descriptive statistics: percentages, mean, and standard deviation
2a. Is there a difference between genders on ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, years of teaching, and personal computer ownership?	Independent Sample *t*- Test
2b. Is there a difference between participants who own computer and those who do not on their ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?	Independent Sample *t*- Test
2c. Is there an interaction between gender and personal computer ownership on ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports?	Factorial ANOVA
3. Are there associations among self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, gender, years of teaching, and personal computer ownership?	Pearson correlation (matrix)
4. Is there a combination of gender, years of teaching, personal computer ownership, self-reported knowledge, user satisfaction, barriers to use, and institutional supports that predicts the usage of information and learning technology in teaching process better than any variable alone?	Multiple regression
5. Is there a combination of gender, years of teaching, personal computer ownership, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports that predicts the self-reported knowledge of information and learning technology better than any variable alone?	Multiple regression

CHAPTER 4: RESULTS

This chapter presents the results of the data analyses of the study. Data were analyzed using the SPSS program. Descriptive statistics were used to provide baseline data about background information of participants including genders, years of teaching experience and personal computer ownership. Chi-square test and phi were used to analyze dichotomous variables. Two set of *t*-tests and a factorial ANOVAs were used to investigate possible associations and differences among participant's characteristics and major constructs of the study. Multiple regression was used to predict a normal dependent variable from a combination of several independent variables. A level of significance (alpha) of .05 was used throughout the data analyses.

The questionnaire was adapted from an instrument originally developed and used by Spotts and Bowman (1995) and later used by Groves and Zemel (2000). The questionnaire was directed at seeking answers to the following research questions:

1. How can the self-reported data from the survey be described?
    a. How can the participants be described?
    b. How can participants' responses to the major constructs be described?

2a. Is there a difference between genders on ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?

2b. Is there a difference between participants who own computer and those who do not on their ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?

2c. Is there an interaction between gender and personal computer ownership on ratings on self-reported knowledge, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports?

3. Are there associations among self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, gender, years of teaching, and personal computer ownership?

4. Is there a combination of gender, years of teaching, personal computer ownership, self-reported knowledge, user satisfaction, barriers to use, and institutional supports that predicts the usage of information and learning technology in teaching process better than any variable alone?

5. Is there a combination of gender, years of teaching, personal computer ownership, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports that predicts the self-reported knowledge of information and learning technology better than any variable alone?

The questionnaire with a cover letter was distributed to all faculty members by a gatekeeper. Faculty had two weeks to complete the questionnaire and return it to a

gatekeeper. Since the number of completed returned questionnaires received was high, the researcher did not conduct a follow-up mailing.

Research Question 1

Participants Characteristics

The questionnaire was completed by 123 participants out of 160 faculty members, including both *genders*[*]. Of the 76.87% response rate, 73 participants were males and 50 participants were females. The percentage of participants who own a personal computer was 68.3%. Inspection of each gender's percentage of *personal computer ownership* indicated that female faculty members have higher percentage of personal computers ownership than male faculty members. The percentage for male computer ownership was 60.3% compared to 80% for female.

Years of teaching experience was also a variable of interest of the study. There were six categories, grouped from a year to 16 or more years of teaching experience. The majority of participants had 4 to 6 years of teaching experience and the group with 10 to 12 years of teaching experience reported the smallest number of participants. The percentage of each group was as follows: 1) a year to 3 years = 26%, 2) 4 to 6 years = 48%, 3) 7 to 9 years = 7.3%, 4) 10 to 12 years = 4.9%, 5) 13 to 15 years = 6.5%, and 6) 16 or more years = 7.3%. Overall, the average length of teaching experience was 4.75 years. Table 4 summarizes the results of percentage of participant characteristic including *genders, years of teaching experiences,* and *personal computer ownership.*

[*] In Chapter four variables are italicized to assist the reader.

Table 4

Percentage of Gender, Personal Computer Ownership, and Years of Teaching Experience Variables

		Percentage (%)
Gender	Male	59.3
	Female	40.7
PC ownership	Yes	68.3
	No	31.7
Years of teaching	1 to 3 years	26
experience	4 to 6 years	48
	7 to 9 years	7.3
	10 to 12 years	4.9
	13 to 15 years	6.5
	16 and more years	7.3

Note. $n = 123$

Description of Participants' Responses to Major Constructs

Table 5 and 6 shows the means and standard deviations of all variables in the study. Participants were asked to describe their attitudes and behaviors related to major constructs of the study including *self-reported knowledge, usage, user satisfaction, barrier,* and *institutional support.* Inspection of skewness of major constructs showed that these distributions were approximately normally distributed. Table 5 shows the means, standard deviations, and skewness of those variables. The mean for the variable *satisfaction*, was the highest, 3.46 ($SD = .722$). On the other hand, the mean of the variable *barriers* was the lowest, 2.43 ($SD = .795$).

Table 5

Mean and Standard Deviation of Other Variables With Information and Learning Technology

			Skewness	
	Mean	SD	Statistic	Std. Error
Self reported knowledge	3.15	.703	-.177	.218
Usage	2.78	.785	-.031	.218
User satisfaction	3.46	.722	.088	.218
Barriers	2.43	.590	-.094	.218
Institutional support	3.05	.795	-.020	.218

Note. $n = 123$

Table 6 summarizes means and standard deviations of major constructs in the study as a function of *gender, personal computer ownership,* and *years of teaching experience.* Of the *genders*, female participants reported a somewhat larger mean than male participants in all variables. Female participant's mean of the variable *self-reported knowledge* was 3.37 compared to 2.99 for males. Thus females said their *self-reported knowledge* was a little above "moderate" while males said "moderate". The means variable *usage* was 2.97 for female participants compared to 2.64 for males, which can be interpreted as females faculty members said their *usage* was a little higher than males faculty members. The variable *user satisfaction* was 3.69 for female participants compared to 3.31 for males, the variable *barriers* was 2.31 for females compared to 2.53 of male participants; and the variable *institutional support* was 3.25 for females compared to 2.92 for male participants.

Of the *personal computer ownership*, the results indicated participants who own personal computers seem to have a higher mean than participants who do not own personal computers on all variables. The largest discrepancy among all variables was the variable *user satisfaction*. Those participants who had a personal computer rated the

average of the variable *user satisfaction* as 3.65 (between satisfied and very satisfied); those who do not own personal computers had a mean of 3.06, slightly above satisfied.

Table 6

Mean and Standard Deviations of Others Variables as a Function of Gender, Personal Computer Ownership and Years of Teaching

		Self[1]		Usage[2]		User[3]		Barrier[4]		Inst[5]	
		M	SD	M	SD	M	SD	M	SD	M	SD
Gender	Male	2.99	.735	2.64	.779	3.31	.709	2.53	.633	2.92	.807
	Female	3.37	.593	2.97	.762	3.69	.687	2.31	.499	3.25	.740
PC* ownership	Yes	3.25	.673	2.90	.790	3.65	.643	2.32	.563	3.29	.747
	No	2.93	.726	2.52	.720	3.06	.726	2.69	.575	2.54	.649
Years of	1 to 3 years	3.21	.676	2.73	.922	3.43	.780	2.48	.667	3.03	.928
teaching	4 to 6 years	3.23	.692	2.93	.704	3.45	.739	2.38	.557	3.02	.718
	7 to 9 years	3.08	.625	2.56	.708	3.26	.767	2.52	.444	2.96	.927
	10 to 12 years	2.87	.974	2.58	1.01	3.63	.548	2.56	.793	3.33	.927
	13 to 15 years	3.07	.741	2.65	.798	3.66	.719	2.08	.378	3.18	1.00
	16 and more years	2.70	.683	2.42	.633	3.61	.525	2.78	.565	3.18	.533

Note. [1]self-reported knowledge; [2]usage;[3]user satisfaction;[4]barriers;[5]institutional supports
*personal computer

Inspection of means related to *years of teaching experience* had mixed results. For the variable *self-reported knowledge* and the variable *usage*, the group with 4 to 6 years of teaching experience had the highest mean ($M = 3.23$ and $M = 2.93$) and the group with 16 or more years of teaching experience had the lowest mean ($M = 2.70$ and $M = 2.42$). The group with 13 to 15 years of teaching experience reported a higher mean in the variable *user satisfaction* ($M = 3.66$). The lowest mean of variable *user satisfaction* reported for the group of 7 to 9 years teaching experience ($M = 3.26$). The

group of 16 or more years of teaching experience reported the highest mean ($M = 2.78$) in the variable *barriers* and the group of 13 to 15 years of teaching experience reported the lowest mean ($M = 2.08$). For the variable *institutional support,* the group with 10 to 12 years teaching experience reported the highest mean ($M = 3.33$) and the group with 7 to 9 years of teaching experience reported the lowest mean ($M = 2.96$).

Self-reported knowledge. Table 7 displays the percentages pertaining to the variable *self-reported knowledge* of information and learning technology of the participants.

Table 7

Percentage of Participants' Responses to Self-reported Knowledge of Information and Learning Technology

Type of information and learning technology	Percentage (%)				
	N[1]	A[2]	M[3]	G[4]	E[5]
Multimedia	.8	13.8	45.5	34.1	5.7
Distance learning	13.8	23.6	46.3	13	3.3
Overhead projector	.8	4.1	17.9	56.1	21.1
Email	.8	4.9	20.3	46.3	27.6
WebCT	13.8	16.3	38.2	26.8	4.9
Word processing	8.9	10.6	31.7	29.3	19.5
Spreadsheet software	8.9	17.1	31.7	31.7	10.6
Database software	9.8	25.2	37.4	23.6	4.1
Presentation software	7.3	13	33.3	30.1	16.3
Computer networks	3.3	12.2	30.9	37.4	16.3
Web authoring software	17.9	22.8	38.2	18.7	2.4
Statistical computing	21.1	21.1	35	22	.8
Programming language	17.9	28.5	35.8	16.3	1.6

Note. [1]none; [2]a little; [3]moderate; [4]good; [5]expert

The variable *self-reported knowledge* was measured by 13 types of technologies and each item was rated on a five point scale with 1 as no knowledge to 5 as highly knowledgeable with the technology. The results showed that 80% of the participants reported their knowledge of the listed technologies as being moderate to high.

Participants knowledge of specific technologies from highest to lowest were: email, overhead projector, computer network, word processing, presentation software, multimedia, spreadsheet software, WebCT, database software, distance learning, web authoring software, statistical computing and programming language. Approximately 28 percent of participants indicated they were highly knowledgeable of email followed by 19.5 percent for word processing. Fewer participants indicated a high level of knowledgeable of web authoring software (2.4%), programming language (1.6%) and statistical computing (.8%). Participants indicated no knowledge to a little knowledge of programming language (46.4%), statistical computing (42.2%), web authoring software (40.7%), and distance learning (37.4%).

Usage of information and learning technology. Table 8 shows the percentages of the variable *usage* of information and learning technology. The results showed the pattern of the variable *usage* of technologies was much the same as the variable *self-reported knowledge* responses. Approximately 33% of the participants indicated usage of the internet to retrieve information for almost every class followed by word processing, and presentation software of 32% compared to other technologies measured in the study. The participants indicated several technologies were used less: the distance learning (56.9%), individual contact with student through email (44.7%), programming language

to design application for class materials (40.7%), use WebCTs to promote class discussion (38.2%), and electronic lists for discussion with colleagues (38.2%).

Table 8

Percentage of Participants' Responses to Usage of Information and Learning Technology

Usage of information and learning technology	Percentage (%)				
	N[1]	1-2[2]	M[3]	W[4]	AE[5]
Multimedia for in-class presentation	12.2	18.7	25.2	24.4	19.5
Multimedia for student individualized learning	16.3	17.1	26	29.3	11.4
Distance learning	56.9	17.1	19.5	4.1	2.4
Computer assisted instruction	11.4	17.9	26.8	26.8	17.1
Email: individualized contact with students	44.7	21.1	13.8	13	7.3
Email: communication with on and off campus colleagues	8.1	16.3	22.8	35	17.9
Class over WebCT to promote class discussion	38.2	26	26	8.1	1.6
Electronic lists for discussions with colleagues	38.2	22	19.5	17.1	3.3
Word processing to prepare exams, class materials	12.2	14.6	17.1	24.4	31.7
Spreadsheet software to analyze grades and records	20.3	23.6	22.8	16.3	17.1
Database software to manage records	22	26	23.6	17.9	10.6
Presentation software to prepare handouts or transparencies	6.5	13.8	22	26	31.7
Internet: information retrieval via World Wide Web, ftp, etc.	6.5	8.9	23.6	27.6	33.3
Internet: web base course	34.1	55.3	78	11.4	10.6
Statistical software to enter, analyze and manipulate data	37.4	17.9	28.5	11.4	4.9
Programming language to designed for scientific, engineering and other application for class materials	40.7	19.5	22	14.6	3.3

Note. [1]never; [2]1 – 2 times per semester; [3]monthly; [4]weekly; [5]almost every class

User satisfaction. Table 9 shows the percentages of eight items that measured the variable *user satisfaction.* Approximately 20% of the participants indicated they were highly satisfied that the use of the technology will increase student interest in learning processes. Nearly 20% of the participants reported that technology has a clear advantage over traditional delivery. On the other hand, the participants indicated several factors in the study that contributed to their dissatisfaction (strongly dissatisfy and dissatisfy) of using current technologies. The factors included time needed to learn the technology (21.1%), how easy the technology was to use in the teaching process (17.9%), and their personal level of comfort with the technology (17.1%).

Table 9

Percentage Participants' Responses to User Satisfaction Items

Satisfaction	Percentage (%)				
	SD[1]	D[2]	S[3]	VS[4]	SS[5]
Ease to use	1.6	16.3	48.8	23.6	9.8
Clear advantage over traditional delivery	0	8.1	39	33.3	19.5
Compatibility with existing materials	.8	10.6	48.8	33.3	6.5
Compatibility with discipline	0	12.2	39	35.8	13
Increased student interest	0	4.9	36.6	38.2	20.3
Improved transfer knowledge and student learning	0	6.5	38.2	39	16.3
Time needed to master it	1.6	19.5	41.5	27.6	9.8
Personal comfort level with technology	5.7	11.4	38.2	30.1	14.6

Note. [1] strongly dissatisfy; [2] dissatisfy; [3] satisfy; [4] very satisfy; [5] strongly satisfy

Barriers to use. Table 10 shows the percentages of six items measuring the variable *barriers* to using the technology as teaching tools. On a 1 to 5 Likert scale rating (1 = not important; 2 = somewhat important; 3 = important; 4 = very important; and 5 = critically important), participants rated as important to critically important the *barriers* variable: not enough time to learn the technology (94.4%), does not contribute to professional advancement (94.3%), and lack of self-interest (93.6%) in using information and learning technology as teaching tools. Only 25.2 percent of the participants felt that it was very important to critically important that the technology be relevant to the discipline. This result shows that faculty members are more likely to support technology that can be used as teaching tools in the classroom.

Table 10

Percentage of Barrier in Using Information and Learning Technology

Barrier	Percentage (%)				
	NI[1]	SI[2]	I[3]	VI[4]	CI[5]
Not enough time to learn	1.6	4.1	41.5	42.3	10.6
Lack of self-interest	1.6	4.9	29.3	42.3	22.0
Not compatible or not relevance to discipline	8.1	17.1	44.7	15.4	14.6
Not contribute to professional advancement	1.6	4.1	26.8	40.7	26.8
Difficulty to access tools and equipments	2.4	6.5	41.5	30.1	19.5
Lack of training	.8	8.1	32.5	37.4	21.1

Note. [1] not important; [2] somewhat important; [3] important; [4] very important; [5] critically important

Institutional support. Table 11 shows the percentages of five items that measured the variable *institutional support.* Based on the responses, all percentages for each item were high for scale rated as supportive with average of 45.7%. Participants reported that the center was helpful (rated as supportive to strongly supportive) in providing support of information related to their discipline (85.4%), administrative support (78.1%), training for faculty member on using the technology (75.4%), equipment availability (69.2%), and funding for necessary materials (67.5%).

Table 11

Percentage of Institutional Support

Institutional support	Percentage (%)				
	NS[1]	SS[2]	S[3]	VS[4]	SSP[5]
Administration supports	7.3	14.6	47.2	22.8	8.1
Equipment availability	9.8	21.1	44.7	18.7	5.7
Funds for necessary materials	8.1	24.4	46.3	16.3	4.9
Training of faculty member on using information and learning technology	4.1	20.3	43.1	20.3	12.2
Information on materials available in discipline	1.6	13	47.2	34.1	4.1

Note. [1] not supportive; [2] somewhat supportive; [3] supportive; [4] very supportive; [5] strongly supportive

Research Question 2

The following pages present the results of inferential statistics. In this study, the researcher set the significance level at 0.05. The strength of the relationship and the magnitude of the relationship between the independent variable and the dependent variable, or the effect size, is interpreted based on Cohen (1988) guidelines.

Table 12 and Table 13 presents results of comparing each of the two independent variables (between groups design) *genders* and *personal computer ownership,* on six approximately normal distributed dependent variables. The dependent variables are *years of teaching experience, self-reported knowledge of information and learning technology, usage of information and learning technology, user satisfaction, barriers to use,* and *institutional support.*

Comparing Genders and Major Constructs

Table 12 shows results of male and female faculty members on each of the six dependent variables. The result reveals males and females were statistically significant different on all dependent variables.

Inspection of the two groups of means signify that female faculty members score significantly higher on all dependent variables including the variable *years of teaching experience.* For the variable *years of teaching experience*, the appropriate t (120.72) = 2.468, $p < .015$. The average years of teaching for male faculty members ($M = 2.64$) is significantly higher than the score for females ($M = 2.04$). The effect size d is approximately .417, which is small to medium.

Table 12

Comparison of Male and Female Faculty Members on Years of Teaching, Self-reported Knowledge of Information and Learning Technology, Usage of Information and Learning Technology, User Satisfaction, Barrier to Use, and Institutional Support (n = 73 males and 50 females)

	M	*SD*	*t*	*df*	*p*
Years of teaching			2.468	120.72*	.015
Male	2.64	1.65			
Female	2.04	1.07			
Self-reported knowledge with information and learning technology			-2.983	121	.003
Male	2.99	.74			
Female	3.37	.59			
Usage of information and learning technology			-2.293	121	.024
Male	2.64	.78			
Female	2.97	.76			
User satisfaction			-2.957	121	.004
Male	3.31	.71			
Female	3.69	.69			
Barrier to use			2.086	121	.039
Male	2.53	.63			
Female	2.30	.50			
Institutional support			-2.331	121	.021
Male	2.92	.80			
Female	3.25	.74			

Note. * Equal variances not assumed

For the variable *self-reported knowledge*, the appropriate t (121) = -2.983, $p <$ .003. Based on means, female faculty members have higher self-reported knowledge with information and learning technology (M = 3.37) than males (M = 2.99). The variable *self-reported knowledge* with information and learning technology has medium to large effect size, d is approximately .558. The appropriate t-test result for the variable *usage* of information and learning technology is t (121) = -2.293, $p <$ .024. The results show female faculty members with mean (M = 2.97) which is significantly higher than male (M = 2.64). The effect size is small to medium, d, approximately .427.

The results of the variable *user satisfaction*, t (121) = -.2.957, $p < .004$, reveals that female faculty members are significantly more satisfied ($M = 3.69$) than male faculty members ($M = 3.31$). The effect size, d approximately .543, is medium to large. The variable *barriers* to use also shows female faculty members indicate fewer barriers in using information and learning technology in teaching process than males. The result of the variable *barriers* to use, t (121) = 2.086, $p < .039$ with effect size, d, of .394. According to Cohen (1988) this is small to medium effect size. For the variable *institutional support*, the results show t (121) = -2.331, $p < .021$, with effect size, d is approximately .423, which is small to medium. The average institutional support for female faculty members ($M = 3.25$) is significantly higher than the score for males ($M =$ 2.92).

Comparing Personal Computer Ownership on Major Constructs

Table 13 presents independent t-test results between faculty members who own personal computer and who do not own on each of six dependent variables included *years of teaching experience, self-reported knowledge with information and learning technology, usage of information and learning technology, user satisfaction, barriers to use,* and *institutional support.*

Table 13

Comparison of Faculty Member Who Own a Personal Computer and Who Do Not on Years of Teaching, Self-reported Knowledge of Information and Learning Technology, Usage of Information and Learning Technology, User Satisfaction, Barriers to Use, and Institutional Support (n = 84 own personal computer and 39 do not own)

	M	*SD*	*t*	*df*	*p*
Years of teaching			2.348	100.3*	.021
Yes	2.58	1.569			
No	2.00	1.124			
Self-reported knowledge with information and learning technology			2.381	121	.019
Yes	3.25	.673			
No	2.93	.726			
Usage of information and learning technology			2.540	121	.012
Yes	2.90	.790			
No	2.52	.720			
User satisfaction			4.552	121	.001
Yes	3.65	.643			
No	3.06	.726			
Barrier to use			-3.378	121	.001
Yes	2.32	.565			
No	2.69	.575			
Institutional support			5.373	121	.001
Yes	3.29	.747			
No	2.54	.649			

Note. * Equal variances not assumed

Table 13 reveals that faculty members who own personal computer were significantly different from faculty members who do not own personal computer on years of teaching. The average of the variable *years of teaching experience* score for faculty members who own personal computer ($M = 2.58$) is significantly higher than the score for those who do not own ($M = 2.00$). The effect size, d is approximately .402, which is small to medium. For the variable *self-reported knowledge* with information and learning technology, the average for faculty who own personal computer is higher ($M = 3.25$) than

faculty who do not own ($M = 2.93$). The effect size d is approximately .464, which is small to medium in this discipline.

The result for the variable *usage* of information and learning technology reveals that faculty members who own a personal computer score higher ($M = 2.90$) than the score ($M = 2.52$) for those who do not own. The effect size is approximately .494, which is medium. Faculty members who own a personal computer also differ significantly from faculty members who do not on the variable *user satisfaction* test ($p < .001$). The effect size is approximately .880, which is larger than typical.

For the variable *barriers* to use, the average for faculty members who do not own personal computer also scored lower ($M = 2.69$) than the score ($M = 2.32$) for those who own a personal computer. The effect size, d, is .651, which is medium to large. The average for the variable *institutional support* for faculty members who own a personal computer ($M = 3.29$) is significantly higher than for those who do not ($M = 2.54$). The effect size d is approximately 1.05, which is much larger than typical in this discipline.

Comparing Gender and Personal Computer Ownership on Major Constructs

Table 14a and Table 14b present result of factorial ANOVA comparing four groups based on the variables *gender* and *personal computer ownership*. Table 14a shows the means and standard deviations for several dependent variables separately for two independent variables; *gender* and *personal computer ownership*.

Table 14a

Means, Standard Deviations, and n for Years of Teaching, Self-reported Knowledge with Information and Learning Technology, Usage of Information and Learning Technology, User Satisfaction, Barrier to Use and Institutional Support as a Function of Gender and Personal Computer Ownership

		Gender						Total	
		Male			Female				
		n	*M*	*SD*	*n*	*M*	*SD*	*M*	*SD*
Years of Teaching									
PC Ownership	Yes	44	3.07	1.731	40	2.05	1.176	2.58	1.569
	No	29	2.00	1.282	10	2.00	0.471	2.00	1.124
	Total	73	2.64	1.645	50	2.04	1.068	2.40	1.464
Self-reported Knowledge with Information and Learning Technology									
PC Ownership	Yes	44	3.10	0.712	40	3.41	0.593	3.25	0.673
	No	29	2.84	0.754	10	3.19	0.592	2.93	0.726
	Total	73	2.99	.0735	50	3.37	0.593	3.15	0.703
Usage of Information and Learning Technology									
PC Ownership	Yes	44	2.79	0.783	40	3.02	0.790	2.90	0.790
	No	29	2.43	0.733	10	2.78	0.643	2.52	0.720
	Total	73	2.64	0.779	50	2.97	0.762	2.78	0.785
User Satisfaction									
PC Ownership	Yes	44	3.56	0.561	40	3.75	0.716	3.65	0.643
	No	29	2.93	0.750	10	3.44	0.511	3.06	0.726
	Total	73	3.31	0.709	50	3.69	0.687	3.46	0.722
Barriers to Use									
PC Ownership	Yes	44	2.39	0.602	40	2.24	0.512	2.32	0.565
	No	29	2.74	0.634	10	2.57	0.353	2.69	0.575
	Total	73	2.53	0.633	50	2.31	0.498	2.44	0.590
Institutional Support									
PC Ownership	Yes	44	3.23	0.740	40	3.36	0.759	3.29	0.747
	No	29	2.44	0.668	10	2.84	0.506	2.54	0.649
	Total	73	2.92	0.807	50	3.25	0.740	3.05	0.795

Table 14a displays that 123 participants are included in the study which of 73 faculty members are males and 50 are females. Of the 73 male faculty members, 44 of them own a personal computer while 29 faculty members do not. In contrast, 40 of female faculty members own a personal computer and 10 of them do not.

Table 14b shows the six factorial ANOVAs including the interactions of *gender* and *personal computer ownership*. Table 14b indicates that there was not a significant

interaction between *gender* and *personal computer ownership* on the variable *years of teaching experience* ($p < .089$). There was also no significant main effect of personal computer ownership on the variable *years of teaching experience* ($p < .062$). Gender also has no significant main effect on the variable *years of teaching experience* ($p < .089$).

For *gender* and *personal computer ownership* on the variable *self-reported knowledge* with information and learning technology, the result indicates there was no significant interaction with $p < .889$. *Personal computer ownership* also reported no significant main effect on the variable *self-reported knowledge* with information and learning technology ($p < .100$). There was, however, a significant main effect of *gender* on the variable *self-reported knowledge* with information and learning technology, F (1, 119) = 5.335, $p < .023$. Eta for *gender* was about .207, a medium effect.

The result shows that there was no significant interaction between the *gender* on the variable *usage* of information and learning technology with $p < .76$. The result between *personal computer ownership* on the variable *usage* of information and learning technology shows no significant interaction with $p < .071$. There was no significant main effect between *gender* and *personal computer ownership* on the variable *usage* of information and learning technology with $p < .7$.

Table 14b

Analysis of Variance for Years of Teaching, Self-reported Knowledge with Information and Learning Technology, Usage of Information and Learning Technology, User Satisfaction, Barriers to Use, and Institutional Support as a Function of Gender and Personal Computer Ownership

	Df	*MS*	*F*	η^2
Years of Teaching				
Gender	1	5.690	2.935	0.024
Personal Computer Ownership	1	6.682	3.540	0.029
Gen*PC Ownership	1	5.690	2.935	0.024
Error	119	1.939		
Self-reported Knowledge with Information and Learning Technology				
Gender	1	2.447	5.335*	0.043
Personal Computer Ownership	1	1.259	2.744	0.023
Gen*PC Ownership	1	0.009	0.020	0.001
Error	119	0.459		
Usage of Information and Learning Technology				
Gender	1	1.867	3.201	0.026
Personal Computer Ownership	1	1.940	3.326	0.027
Gen*PC Ownership	1	0.087	0.149	0.001
Error	119	0.583		
User Satisfaction				
Gender	1	2.689	6.198*	0.050
Personal Computer Ownership	1	4.893	11.281**	0.087
Gen*PC Ownership	1	0.583	1.240	0.010
Error	119	0.434		
Barriers to Use				
Gender	1	0.566	1.766	0.015
Personal Computer Ownership	1	2.442	7.608**	0.061
Gen*PC Ownership	1	0.002	0.005	0.001
Error	119	0.322		
Institutional Support				
Gender	1	1.494	2.926	0.024
Personal Computer Ownership	1	9.353	18.315**	0.133
Gen*PC Ownership	1	0.416	0.815	0.007
Error	119	0.511		

Note. $^{*}p < 0.05$; $^{**}p < 0.01$

There was not a significant interaction between *gender* and *personal computer ownership* on the variable *user satisfaction* ($p < .268$). However, there was a significant main effect of *gender* on the variable *user satisfaction*, $F(1, 119) = 6.198, p < .014, \eta = .224$. The effect size is medium or typical. For *personal computer ownership*, there also a significant main effect on the variable *user satisfaction*, $F(1, 119) = 11.281, p < .001, \eta = .295$ which also a medium to large effect size.

Table 14b also indicated that male faculty members who own personal computer reported higher mean ($M = 3.56$) than those who do not own ($M = 2.93$). Female faculty members who own personal computer reported a higher mean ($M = 3.75$) than those who do not own ($M = 3.44$). This of course is similar to the *t*-test results reported earlier in the chapter. However, the results showed that there was not a significant interaction between *gender* and *personal computer ownership* on the variable *barriers* to use ($p < .959$).

There was no significant main effect of *gender* on the variable *barriers* to use information and learning technology in teaching processes ($p < .182$). However, there was a significant main effect of personal computer ownership on the variable *barriers* to use, $F(1, 119) = 7.608, p < .007, \eta = .247$ which is medium or typical effect size (Cohen, 1988). Male faculty members who own personal computer reported lower mean ($M = 2.39$) than those who do not own ($M = 2.74$). Female faculty members who own personal computer also reported lower mean ($M = 2.24$) than those who do not own ($M = 2.57$).

For the variable *institutional support*, there was not a significant main effect of *gender* on the variable *institutional support* ($p < .09$). There was also not a significant interaction between *gender* and *personal computer ownership* on the variable *institutional support* ($p < .368$). However, there was a significant main effect of *personal*

computer ownership on the variable *institutional support*, $F(1, 119) = 18.315, p < .001$, $\eta = .365$, which is larger than typical effect size.

Research Question 3

Associations Related to Background Characteristics

Table 15 shows the relationship between two dichotomous variables using chi-square to measure the statistically significant relationship and phi to assess the strength of relationship.

Table 15

Chi-square Analysis of Prevalence of Personal Computer Ownership among Males and Females

Variable	*N*	Personal Computer Ownership		χ^2	*p*
		Own	Not Own		
Gender				5.33	.021
Males	73	44	29		
Females	50	40	10		
Totals	123	84	39		

There are 44 males who own a personal computer out of 73 male participants. Of the 50 female participants, 40 of them own a personal computer. The table shows the Pearson chi-square results and indicates that males and females are significantly different on whether they own a personal computer or not ($\chi^2 = 5.33$. $df = 1, N = 123, p < .021$). Female faculty members were more likely to own a personal computer than males. Phi is -.208 indicates the effect size is considered small to medium according to Cohen (1988).

Associations Related to Major Constructs

Pearson correlations were computed to investigate if there was a statistically significant association among the variables *years of teaching experience, self-reported knowledge of information and learning technology, usage of information and learning technology, user satisfaction, barriers to use, and institutional support.* Table 16 shows that 11 of the 15 pairs of variables were significantly correlated.

Table 16

Intercorrelations, Means, and Standard Deviations for Other Six Variables

	1	2	3	4	5	6	*M*	*SD*
1. Years of teaching	-	-.191*	-.132	.085	.042	.074	2.40	1.46
2. Self-reported knowledge with information and learning technology		-	.719***	.595***	-.440***	.248**	3.15	.703
3. Usage of information and learning technology			-	.591***	-.368***	.276**	2.78	.785
4. User satisfaction				-	-.516***	.529***	3.46	.722
5. Barrier to use					-	-.313***	2.44	.590
6. Institutional support						-	3.05	.795

Note. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

The strongest positive correlation, which would be considered a much larger than typical effect size, was between the variable *self-reported knowledge* of information and learning technology and the variable *usage* of information and learning technology, $r(121) = .719, p < .001$. This means that faculty members who had relatively high self-reported knowledge were likely to use information and learning technology in the teaching processes. The results also indicated that the variable *user satisfaction* had a

positive correlation with four other variables with a larger than typical effect size. The strongest positive correlation which considered a larger than typical effect size, was between the variable *user satisfaction* and the variable *self-reported knowledge* of information and learning technology, r (121) = .595, p < .001. This means that faculty members with higher self-reported knowledge were more likely to have higher satisfaction or vice versa. The variable *user satisfaction* had significantly positive correlation with the variable *usage* of information and learning technology, r (121) = .591, p < .001. This suggests that faculty members with higher satisfaction were more likely to use the technology or vice versa.

The variable *user satisfaction* had a negative correlation with the variable *barrier* to use, r (121) = -.516, p < .001. This indicated that faculty member that had higher satisfaction were more likely to have fewer barrier with the technology or vice versa. The variable *user satisfaction* had positive correlation with the variable *institutional support*, r (121) = .529, p < .001. This means faculty member who have higher satisfaction tend to have more support from the center and vice versa. The results indicated that the variable *user satisfaction* was not significantly correlated with variable *years of teaching experience.*

Table 16 also shows that the variable *barrier* was negatively correlated with the variable *self-reported knowledge* of information and learning technology (r = -.440, p < .001) indicated that faculty members who had a higher rating on the variable barrier were more likely to have lower rating of self-reported knowledge with technology or vice versa.

The variable *barrier* was statistically significant with the variable *usage* of information and learning technology ($r = -.370, p < .001$). The direction of correlation was negative, indicated faculty members who have rated lower barriers were likely to use more of the technology and vice versa. The variable *barrier* was statistically significant with institutional support ($r = -.313, p < .001$). This means faculty members who have rated lower barriers were more likely to have higher support from the center and vice versa. These correlations have an effect size of medium to large.

In addition, the variable *institutional support* was positively correlated with the variable *self-reported knowledge* with information and learning technology ($r = .248, p < .006$) indicating faculty members who have more support from the center were likely to have higher self-reported knowledge and vice versa. The variable *institutional support* was significantly correlated with the variable *usage* of information and learning technology ($r = .276, p < .002$) with small to medium effect size. This means faculty members who have higher support from the center were likely to use more technology and vice versa.

Research Question 4

Predicting Usage of Information and Learning Technology

Table 17 display the results of simultaneous multiple regression to investigate the best predictors of the variable *usage* of information and learning technology. The researcher checked the assumptions that the relationship between each of the predictor variables and dependent variables is linear, the errors are normally distributed and the variance of the residuals is constant. The beta coefficients can be found in Table 17. In this study, multicollinearity is not a problem and concern for this model. According to

Allison (1999), multicollinearity is only a minor concern for model whose primary goal is the best overall prediction from a specified set of variables.

The assumptions of the result was focused that the relationship between each of the predictor variables and usage of the technology was linear, the errors are normally distributed and the variance of the residuals is constant. The prediction of the variable *usage* of information and learning technology from *gender, years of teaching, personal computer ownership, self-reported knowledge with information and learning technology, user satisfaction, barrier to use,* and *institutional support* resulted in Table 17, F (7, 115) = 21.06, $p < .001$.

Table 17

Simultaneous Multiple Regression Analysis Summary for Years of Teaching, Gender, Personal Computer Ownership, Self-reported Knowledge with Information and Learning Technology, User Satisfaction, Barrier to Use, and Institutional Support Predicting Usage of Information and Learning Technology (N = 123)

	B	SEB	β
Years of teaching	-.032	.036	-.059
Gender	-.041	.107	-.026
Personal Computer Ownership	.044	.122	.026
Self-reported Knowledge of Information and Learning Technology	.622	.092	.557***
User satisfaction	.297	.103	.273**
Barrier to use	.031	.099	.023
Institutional support	-.001	.076	-.001
Constant	.086	.486	

Note. $R^2 = .562$; $F(7,115) = 10.06, p < 0.001$
$^{**}p < 0.01$; $^{***}p < 0.001$

Table 17 provides evidence that the variable *self-reported knowledge* with information and learning technology and the variable *user satisfaction* were the best predictors of the variable *usage* of information and learning technology when all seven

variables are included. The variable *self-reported knowledge* is simply the rate of participant competency and proficiency with information and learning technology. The estimated regression coefficient for the variable *self-reported knowledge* in the model is .622. This means that with each additional degree of self-reported knowledge, the usage of information and learning technology goes up, on average, by .622. The variable *user satisfaction* is the participant subjective assessment to current information and learning technology. The model estimated regression coefficient for the variable *user satisfaction* was .297. This indicates that each degree of increase in satisfaction is associated with an increase of .297 in usage of information and learning technology.

R^2 for the model was .562 and the adjusted R^2 value was .535. This indicates that 53% of the variance in usage of information and learning technology was explained by the model. According to Cohen (1988) this is a larger than typical effect.

Research Question 5

Predicting Self-reported Knowledge of Information and Learning Technology

Table 18 display the results of simultaneous multiple regression to investigate the best predictors of the variable *self-reported knowledge* with information and learning technology. As noted in earlier discussion, multicollinearity is only a minor concern for this model which is primary goal is prediction (Allison, 1999).

As with the prediction of usage of information and learning technology, this result of the simultaneous multiple regression analysis also checked assumptions that the relationship between each of the predictor variables and self-reported knowledge with information and learning technology is linear, the errors are normally distributed, and the variance of the residuals is constant.

The combination of all independent variables to predict the variable *self-reported knowledge* with information and learning technology was statistically significant, F (7, 115) = 24.547, $p < .001$. The combination of the best two predictors, the variable *usage* and the variable *user satisfaction* to predict the variable *self-reported knowledge,* resulted in F (2.120) = 76.916, $p < .001$. The beta coefficients are presented in Table 18.

Table 18

Simultaneous Multiple Regression Analysis Summary for Years of Teaching, Gender, Personal Computer Ownership, Usage of Information and Learning Technology, User Satisfaction, Barrier to Use, and Institutional Support Predicting Self-reported Knowledge with Information and Learning Technology (N = 123)

	B	SEB	β
Years of teaching	-.060	.031	-.126
Gender	.079	.091	.055
Personal Computer Ownership	.007	.104	.005
Usage of Information and Learning Technology	.456	.068	.510***
User satisfaction	.258	.088	.265**
Barrier to use	-.146	.083	-.123
Institutional support	-.067	.065	-.077
Constant	.715	.411	

Note. $R^2 = .599$; $F(7,115) = 24.55$, $p < 0.001$
$^{**}p < 0.01$; $^{***}p < 0.001$

The beta coefficient as displayed in Table 18 reported that the variable *usage* of information and learning technology and the variable *user satisfaction* significantly predict the variable *self-reported knowledge* with information and learning technology when all seven independent variables are included. The variable *usage* means the degree of participant utilization of the information and learning technology. The estimated regression coefficient for the variable usage in the model is .456. This means that with each additional degree of usage, the self-reported knowledge of information and learning

technology goes up, on average by .456. While, the model estimated regression coefficient for the variable *user satisfaction* was .258. This indicates that each degree of increase in satisfaction is associated with an increase of .258 in self-reported knowledge of information and learning technology.

R^2 for the model was .599 and the adjusted R^2 value was .575. This indicates that 57% of the variance in the variable *self-reported knowledge* of information and learning technology was explained by the model. This is a larger than typical effect size.

Summary

The participants in this study were recruited from the Center of Instructor and Advanced Skills Training, Shah Alam, Malaysia. The center was established in 1984 with collaboration between the Malaysian and the Japanese government under ASEAN Human Resources Development Project. Both genders, with range of teaching experience from a year to more than 16 years, were included as participants. The average participant's years of teaching experience was approximately 5 years. Approximately 80% of female faculty members own a personal computer and 68% of male faculty members own a personal computer.

In general, participants rated their *satisfaction* (satisfied to very satisfied) and *self-reported knowledge* of current information and learning technology higher than average. However, their *usage* was less than average. Although participants indicated that information and learning technology were important as a teaching tool, the reality suggests that few faculty members were actually using them in the teaching process. On the other hand, participants rated their institutions slightly higher than "supportive" in using the technology, but for below "very supportive".

The chi-square test indicates males and females faculty member were significantly different on the variable *personal computer ownership*. The result favors female faculty members who were more likely to own a personal computer than males. The results of Pearson correlations show a statistically significant positive association between several variables including 1) the variable *self-reported knowledge* and the variable *usage* of information and learning technology, 2) the variable *self-reported knowledge* and the variable *user satisfaction*, 3) the variable *self-reported knowledge* and the variable *barrier* to use, 4) the variable *self-reported knowledge* and the variable *institutional support*, 5) the variable *usage* and the variable *user satisfaction*, 6) the variable *usage* and the variable *barriers* to use, 7) the variable *usage* and the variable *institutional support*, 8) the variable *user satisfaction* and the variable *barriers* to use, 9) the variable *user satisfaction* and the variable *institutional support*, and 10) the variable *barriers* to use and the variable *institutional support*. While, the result revealed a statistically significant negative correlation between the variable *years of teaching experience* and the variable *self-reported knowledge*.

The faculty characteristics of the *gender* and *personal computer ownership* were investigated by using *t*-test for differences in means. The results of comparing *genders* and *personal computer ownership* revealed that male and female faculty members were rated themselves statistically significant higher on *years of teaching experience, self-reported knowledge, usage, satisfaction, barriers, and institutional support.* There were no significant interactions between *gender* and *personal computer ownership* on any of the dependent variables

The results of simultaneous multiple regression seem to suggest that the variable *user satisfaction* and the variable *self-reported knowledge* were the best predictors for the variable *usage* of information and learning technology. Another finding of simultaneous multiple regression suggest that the variable *user satisfaction* and the variable *usage* were the best predictors for the variable *self-reported knowledge* of information and learning technology.

CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

The purpose of this study was to explore the relationships of gender, personal computer ownership, years of teaching, self-reported knowledge, barriers to use, institutional supports, and usage of information and learning technology among career and technical educators in Malaysia. Findings of the study provide a direction to career and technical education system policy makers, administrators, and institutions in Malaysia on how to enhance the diffusion of information and learning technology in the teaching process for the benefits of both educators and learners.

This chapter presents a discussion, recommendations, limitations of the study, and suggestions for future research. The discussion and summary is organized according to the research questions. The recommendations section includes implications for practice and suggestion for future research. In the limitations section, the researcher describes weakness in the design of the study.

Discussion

The following section is a discussion and summary from the findings of the study. Conclusions are made following each research question (the research question is in *italics*). A questionnaire that contained 51 items with a cover letter was sent to all faculty members at the Center for Instructor and Advanced Skills Training, Malaysia. There were 48 items with Likert scale responses ranging from 1 (lower) to 5 (higher) and three demographic items including gender, personal computer ownership, and years of teaching experience. Of 160 faculty members, 123 completed and returned the questionnaire with

valid responses within two weeks, for a final response rate of 76.88% which is considered to be a high response range (Creswell, 2002). The researcher used several strategies to encourage higher return rates. These strategies included notifying participants that they would receive a questionnaire, support and consent from the director of the center, using an inside senior faculty member as gatekeeper who handed out the questionnaire to individual faculty members and collected it, and a cover letter that told participants the purpose of the study and that their participation was voluntary.

Response bias was always a concern of the researcher. It is an interest of the researcher to generalize the results of the study to the Malaysian career and technical education system in general although random sampling was not used. There are reasons to believe that the faculty members from the center would differ little from other faculty at career and technical training facilities throughout the country. However, this is a judgment or belief and is not a product of the sampling procedure or external validity measures.

Research Question One

How can the self-reported data from the survey be described?

a) *How can participants be described?*

b) *How can participants' responses to the major constructs be described?*

The participants of the study were recruited from faculty members of the Center of Instructor and Advanced Skills Training in Shah Alam, Malaysia. Participants were educators who teach different programs in career and technical education at the center. They provides basic and advanced skill training for three different groups including educators of other public skill training institutions, fresh graduates from high school, and

workers from private companies. The programs offer included welding technology, automotive technology, quality control technology, machine and mold technology, production technology, computer network technology, computers system technology, telecommunication technology, electronic technology, mechatronic technology, plastic technology, pedagogy, supervise training, software and multimedia development. Participants are included from both genders with 59.3% males and 40.7% females.

The results of the study suggest that participants who own a personal computer appear to use more technology and have high self-reported knowledge of information and learning technology. The percentage of participants who own personal computers was 68.3%. Of that number, 52.4% of them were males and 47.6% were females. Of the total participants, a higher percentage of females owned personal computers (80%) compared to 60.3% of male faculty. These results suggest that female faculty members were not alienated from using technology as a teaching tool. This finding is similar to Spotts, Bowman, & Mertz (1997) who stated that there is little if any evidence that supports the existence of gender differences in attitudes toward technology, and a few potential gender differences related to faculty use of and attitudes toward instructional technology in higher education.

Both male and female faculty members responded similarly on the importance of information and learning technology as a teaching tool. However, there is not enough evidence in this study to examine the differences on how male and female faculty members rate their relative knowledge and usage of information and learning technology.

The results show participants with 16 or more years of teaching experience indicated a high percentage of self-reported knowledge and use of technology. The

findings suggest that faculty members with extended teaching experience are similar to younger faculty members in terms of enthusiasm to use technology as their teaching tools.

Faculty members are more likely to adopt more than a single technology compared to a decade before where only word processing was being used by the majority of faculty members. Participants indicated the Internet, word processing, and presentation software were used on regular basis. Moreover, the results show faculty members had low computer anxiety levels, and have demonstrated positive attitudes toward the technology. These findings similar to Hong and Koh (2002) and support Rogers (2003) diffusion of innovation model that stated individuals in a social system adopt an innovation over-time. Further, results support findings from Groves and Zemel (2000) who suggested a majority of educators are comfortable using technology on a regular basis.

Although the majority of faculty members indicated that information and learning technology are important as teaching tools, the findings indicated a lack of support from the Center of Instructor and Advanced Skills Training. As stated by Black and Gregerson (2002); Fullan (2001); Lientz and Rea (2004); Senge et al. (1994); and Senge et al. (1999) institutional support is an important factor of faculty members using information and learning technology. In addition, Morrison and Osborn (2005) believed that the root cause for not supporting technology was an incompatibility between the way the educational system is organized and innovation itself. The center needs to manage the adoption of information and learning technology effectively in order to attract more faculty members in the use of the technology.

Based on the results of this study, several factors were identified as contributors to faculty member satisfaction with current technology. These factors included ease of use, a clear advantage over traditional delivery, compatibility with existing materials and discipline, increased student interest, improved transfer knowledge and student learning, time to practice, and personal comfort level with technology. According to Bennett and Bennett (2002) those characteristics may influence a faculty member's willingness to integrate information and learning technology in their teaching processes.

Research Question Two

a. *Is there a difference between gender on ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?*

b. *Is there a difference between participants who own computer and those who do not on their ratings of self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, and barriers to use?*

c. *Is there an interaction between gender and personal computer ownership on ratings on self-reported knowledge, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports?*

The literature reviewed revealed that there is evidence of potential gender differences related to equality of access, attitudes, and anxieties about technology. The results of this study revealed gender differences existed among the faculty member responses in regard to years of teaching experience, self-reported knowledge, usage, user satisfaction, barriers, and institutional support.

Compared to males, females self-reported slightly higher levels of knowledge, usage, satisfaction, and institutional support of information and learning technology. Males self reported that they had more barriers and years of teaching experience. The findings also show that male and female faculty members were at different comfort levels in using information and learning technology. Venkatesh and Morris (2000) stated that males are more influenced by perceptions of usefulness of the product and females are more influenced by their perception of how easy the technology is to use. These results appear to support that a gender difference exists related to experience with information and learning technology.

On average, the results show that faculty members who own a personal computer had more years of teaching experience than faculty members who did not own a personal computer. Faculty members who own a personal computer were more likely to have higher self-reported knowledge than those who did not own a personal computer. The results suggest that faculty members who own personal computers are more likely to explore and spend time using the information and learning technology to develop their self-reported knowledge. Also, these findings suggest that those who own a personal computer have higher usage of technology. These results are similar to Wilson (2003) who noticed that faculty learn about technology primarily through self-help.

The results suggest there is a gender difference in terms of personal computer ownership and user satisfaction. These findings showed that female faculty members who own personal computers were more likely to self-report higher satisfaction than male faculty members. These results are similar to Igbaria and Tan (1997) findings that stated successful adoption of technology was dependent on faculty member's level of

satisfaction with the technology. Further, DeLone and McLean (1992) noticed those users who had higher levels of satisfaction with the information and learning technology were also more likely to have higher levels of job performance.

The findings suggest that personal computer ownership has a small effect on barriers. Faculty members who had personal computers were likely to experience fewer barriers in using the technology. As identified by Butler and Sellbom (2003), there are three factors which impose barriers to the adoption of information and learning technology as teaching tools. These factors include (a) lack of institutional support, (b) lack of financial support, and (c) lack of time to learn new technologies.

Research Question Three

Are there associations among self-reported knowledge, usage of information and learning technology, user satisfaction, institutional supports, barriers to use, gender, years of teaching and personal computer ownership?

Gender and personal computer ownership appeared to have an influence on self-reported knowledge, usage of information and learning technology, user satisfaction, institutional support, and barriers to use the technology. Females are more likely than expected to own a personal computer compared to male faculty members.

Regarding self-reported knowledge of information and learning technology, the results of the study revealed similar findings with previous studies (Spotts & Bowman, 1995; Groves & Zemel, 2000). It appears faculty members that are satisfied with the current technology and rate their self-reported knowledge with technology as high were likely to use and implement the technology into their teaching practices. In this case, the findings show that when a faculty member is persuaded by the information and learning

technology as a tool in helping their teaching practices, they form a favorable attitude toward the technology as noted by Rogers (2003). This finding also supports Groves and Zemel (2000) findings that stated the extent and rate of technology adoption is related to availability of resources and acceptance of innovations by faculty members.

The association between user satisfaction and usage indicated faculty members who had higher satisfaction were more likely to use technology as a teaching tool. This result supports Rogers (2003), Groves and Zemel (2000), Spotts and Bowmann (1995), Sherry et al. (2002), Bennett and Bennett (2003), and Butler and Sellbom (2002) that user satisfaction influences faculty members use of information and learning technology.

The findings of the study suggest that institutional support plays an important factor in the adoption of information and learning technology. Lynch (2002) acknowledged that inadequate support from the institution contributed to a decrease in faculty member use of information and learning technology in their teaching practices. In addition, Butler and Sellbom (2002) stated that a lack of institutional support posed a major barrier to adoption and use of information and learning technology. Since institutional supports were important to drive adoption, the Center of Instructor and Advanced Skills Training should assure that their campus has a reliable program to support the information and learning technology.

The results of the study revealed that the variable *barriers* had a significant negative correlation with user satisfaction, self-reported knowledge, usage, and institutional support. Faculty members that reported higher satisfaction, knowledge, usage, and support of technology were more likely to reported lower barriers. A study by Butler and Sellbom (2002) revealed that even faculty with high levels of proficiency

generally identified the same barriers as faculty with low levels of proficiency in adoption of technology. These findings suggest that faculty members fall into all categories along the adoption curve (Rogers, 2003) from innovators to laggards. A study by Butler and Sellbom (2002) indicated that the lack of institutional support posed a major barrier to adoption and use of information and learning technology. Butler and Sellbom (2002) suggested encouraging faculty members to adopt technologies as teaching tools, the center should have a systematic program including improved reliability of technology, training program to use technology as teaching tools, explain the worth of using technology, and improve institutional support.

Bennett and Bennett (2003) concluded in their study that the success of a faculty training program of adoption of information and learning technology emphasizes the importance of considering several factors. Factors include (a) relative advantage of technology, (b) offering demonstrations of how the technology can be utilized to enhance teaching and learning, (c) providing participants with the opportunity to 'test drive' the technology, (d) giving consideration to the faculty members' level of comfort with technology, and (e) showing how the technology fits with their values and philosophies teaching. Sherry et al. (2000) believed that educators evolve from learners to adopters of information and learning technology, to co-learners/co-explorers with their students in the classroom and finally to a reaffirmation (or rejection) decision.

The result also revealed that years of teaching experience and self-reported knowledge had negative association. This means that additional years of teaching experience reduces the degree of self-reported knowledge of information and learning technology. Although this association is statistically significant, the effect is small. It

also indicates that newer educators tend to have higher self-reported knowledge of information and learning technology. Faculty members who had more experiences in teaching were more likely to be classified in late majority or laggards categories (Rogers, 2003). Those faculty members who fall under these categories required additional motivation such as pressure from colleagues to improve the quality of curriculum. The laggards are near isolates in the social networks of their system because they usually make a decision from what has been done previously and also have limited resources (Rogers, 2003).

Research Question Four

Is there a combination of the factors of gender, years of teaching, personal computer ownership, self-reported knowledge, user satisfaction, barriers to use, and institutional supports that predicts the usage of information and learning technology in teaching process better than any variable alone?

A model composed of seven independent variables for predicting the usage of information and learning technology was developed by the researcher based on the findings of the literature. The model consists three major categories of personal characteristics, barriers, and institutional supports. Figure 5 displays the model for predicting faculty member's usage of information and learning technology that was tested with the data from the present study.

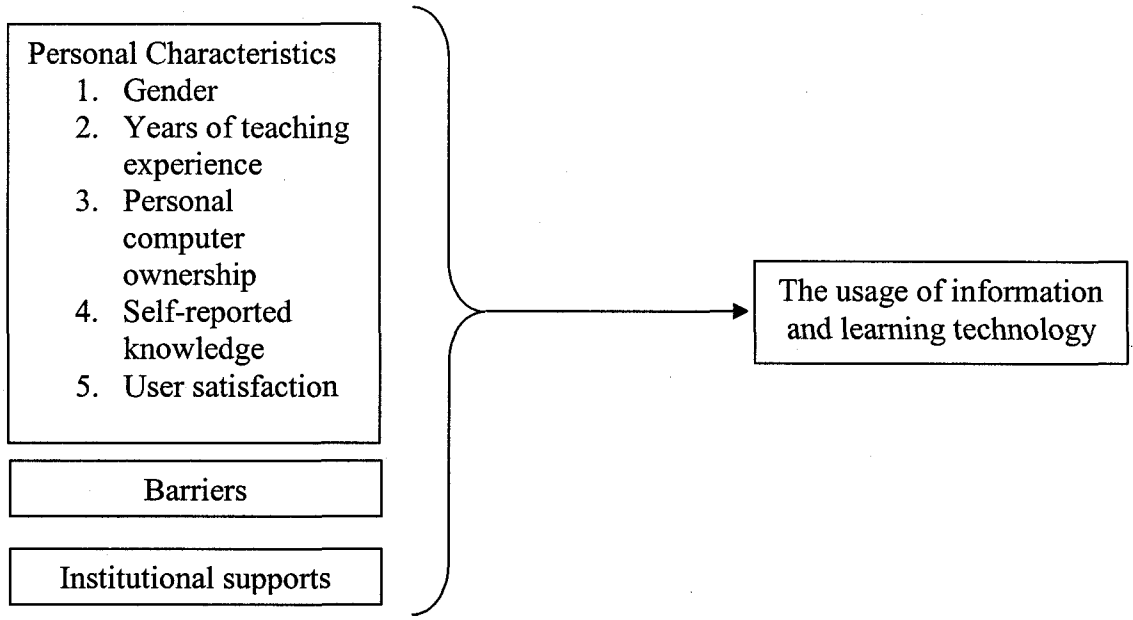

Figure 5. The model for predicting the Malaysian career and technical educator's usage of information and learning technology

Based on the results of the study, it is evident that there may be differences in how faculty member personal characteristics, perceived barriers, and institutional support rate on their usage of information and learning technology. The results suggest that self-reported knowledge and user satisfaction have a large effect on usage of information and learning technology. It appears that the degree of usage will increase as faculty members become more satisfied and have more knowledge of information and learning technology.

Research Question Five

Is there a combination of the factors of gender, years of teaching, personal computer ownership, usage of information and learning technology, user satisfaction, barriers to use, and institutional supports that predicts the self-reported knowledge of information and learning technology better than any variable alone?

As in research question 4, this model was developed based on the findings of the literature composed of seven independent variables for predicting the variable *self-reported knowledge* of information and learning technology. The model consists of three major categories including personal characteristics, barriers, and institutional support. Figure 6 displays the model for predicting faculty member's self-reported knowledge of information and learning technology that was tested with the data from the present study.

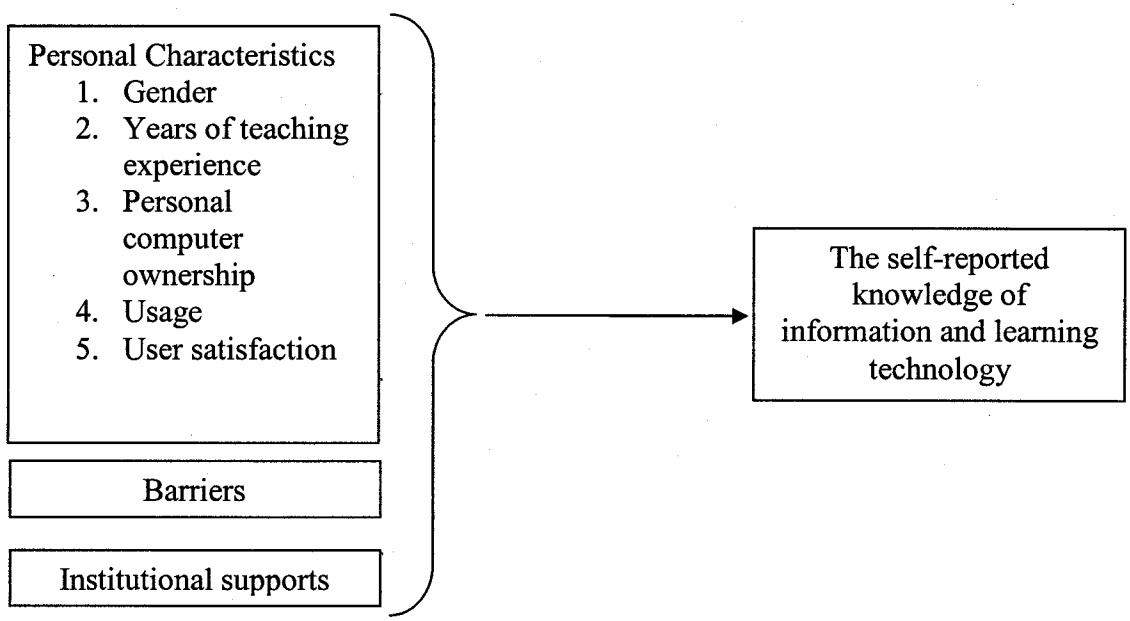

Figure 6. The model for predicting the Malaysian career and technical educator's self-reported knowledge of information and learning technology

The results suggest that the best predictors of self-reported knowledge were usage and user satisfaction of information and learning technology. On average, the degree of self-reported knowledge increased as faculty member's level of satisfaction and usage increased. With each additional degree of increase in usage of information and learning technology there was an associated increase of .456 for self-reported knowledge.

Summary

Participants of the study are teaching various programs in career and technical education at the Center of Instructor and Advanced Skill Training, Shah Alam, Malaysia. They have from one year to 16 or more years of teaching experience. There were a total of 123 participants: 73 were males and 50 were females. Of that number, 84 had a personal computer. The participants revealed high satisfaction with current technology available in the market and reported having more than average knowledge. However, their usage of the technology in teaching practices was reported less than average. Faculty members who own a personal computer yet had fewer years of teaching experience were more likely to report having more knowledge of the technology. Two factors need to be addressed in increasing the usage of the technology as a teaching tool. These include barriers and institutional support. Both of these factors appear to have contributed to lower knowledge and usage of technology as a teaching tool.

The findings of the study revealed that user satisfaction and self-reported knowledge are two main factors that drive the usage of information and learning technology. The results also revealed that faculty members who are satisfied with the technology and own a personal computer were more likely use it as a teaching tool. The results of multiple regression show user satisfaction and self-reported knowledge seem to have an effect on usage of information and learning technology. In addition, the result of multiple regression also revealed that user satisfaction and usage seem to have an effect on self-reported knowledge of information and learning technology.

The findings suggest that career and technical faculty members in the Center of Instructor and Advanced Skills Training go through different lifespan factors as they

develop knowledge and use the information and learning technology. Figure 7 depicts how faculty members adopt the information and learning technology.

The model consists of several factors that may influence a faculty member's likelihood of utilizing the information and learning technology as a teaching tool. In general, the model is an adaptation of a framework created by Rogers (2003) titled the innovation-decision process. When someone is confronted with a new information and learning technology, he/she goes through an adoption decision process in which he/she gathers information, tests the technology, and then considers whether it offers a sufficient improvement to warrant the investment of time and energy that is required to add it to his/her repertoire of skills (Rogers, 2003).

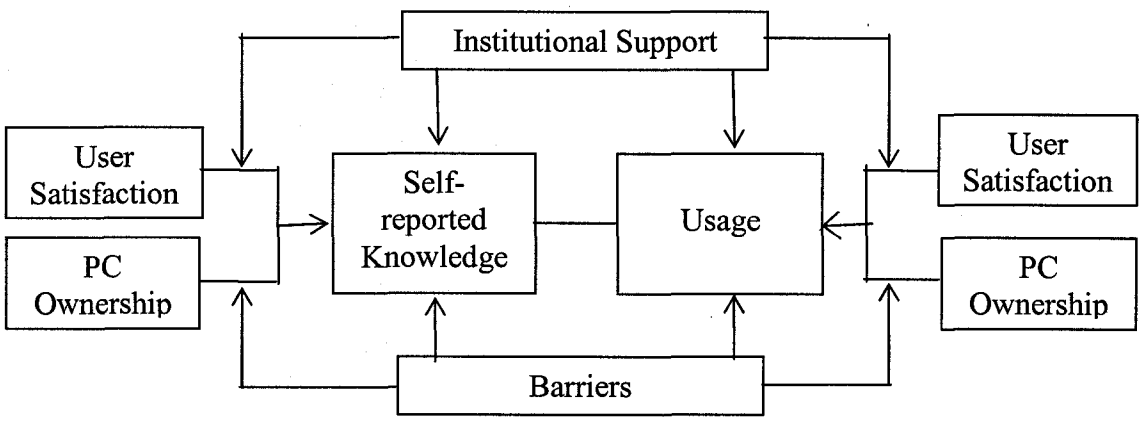

Figure 7. Lifespan factors of usage of information and learning technology among career and technical educators at the Center of Instructor and Advanced Skills Training in Malaysia

Figure 7 describes a process in which faculty members interact throughout the life span of an adoption or rejecting the information and learning technology. In addition, the figure also shows a progression of both user satisfaction and personal computer

ownership on the part of the faculty. Faculty members go through the innovation-decision process by gathering information, testing the technology, and then considering either rejecting or adopting the technology. When faculty members level of satisfaction increases and ownership of personal computer increases then there is a higher likelihood of usage and knowledge. The model also shows that institutional support and barriers play an important role in influencing faculty members to adopt the technology. Administrative supports and fewer barriers to access equipment such as availability of equipment to develop lessons also contributed key roles in adoption the information and learning technology.

Limitations

The researcher identified several weaknesses in the design of the study. The following are limitations of the study:

1. Faculty members were asked to state their self-reported knowledge and usage of technology. This could be a potentially sensitive area for some faculty member, who may feel threatened with job security in answering this question.
2. The responses were based on faculty member's perceptions and experiences with information and learning technology at the present. Since the data were collected at one point in time, evidence for this procedure will reflect current attitudes and trends of the participants.
3. All participants reside in the same geographic area. The condition in this area may not exist in other areas especially in rural areas, where, for instance, access to internet may be limited.

4. The study did not examine causes for gender differences in how male and female faculty members rate their performances with technologies and how they learn to use technology; therefore, the results did not indicate the reason for the existence of differences between male and female faculty members.
5. The purposive sampling used in this study decreases the generalizability of the findings.

Recommendations

Utilizing information and learning technology as teaching tools is a complex process. There are many factors that drive and affect educators for adopting information and learning technology in their teaching practices. On the basis of the findings of the study and the discussion in the previous section, the following are some recommendations that can put the center and other career and technical institutions on a path of adoption of information and learning technology.

1. The Center of Instructor and Advanced Skill Training or other career and technical institutions should consider revitalize and rethink its goals to integrate and utilize information and learning technology as a teaching tool.
2. According to Morrison & Osborn (2005) organic education has powerful tools that can spark change transformation in an education organization. The center or other career and technical institutions should apply organic education systems that empower faculty members with responsibility and tools and to connect them in collaborative structures.

3. The center or other career and technical institutions should design continuous training and workshop programs on development of teaching and learning strategies with information and learning technology. These training session and workshops should discuss the relative advantages of the technology, offering demonstrations of how the technology can be utilized to enhance teaching and learning process, providing participants with the opportunity to 'test drive' the technology, giving consideration to the faculty members' level of comfort of technology and showing how the technology fits with the faculty members' values and philosophies of teaching (Bennett & Bennett, 2003).
4. The center or other career and technical institutions should create and appoint information and learning technology services unit to help with managing (including purchasing), checking, maintaining, updating and supporting faculty members adopt the information and learning technologies.
5. The center or other career and technical institutions should improve quality control of information and learning technology as suggested by Butler and Sellbom (2002). These can be done by raising reliability by installing highly reliability technology in classrooms and by improving systems for checking and maintaining classroom technology.
6. The center or other career and technical institutions should help faculty members through financial support, rewards, and appreciations to create in-house active peer collaboration groups and peers review to discuss,

mentoring and evaluating effectiveness of the information and learning technology software, systems, and pedagogy used in teaching processes. These rewards and appreciations should include release time, monetary awards, software and hardware support, credit in salary, promotion, and tenure process (Chizmar & Williams, 2001). In addition, these will also help in reducing faculty member resistance to changes and inadequate attitudes and behaviors among faculty members.

7. The center or other career and technical institutions should design new curriculum and new model for pre-service educators to develop new perspectives and skills on information and learning technology. Pre-service educators have the potential to effectively adopt and integrate the technologies into their teaching settings and environments to influence student be an active participants instead of being mere receivers of learning content in the learning process.

Suggestions for Future Research

This study raises a need for further study to support the efforts of adoption and utilization of information and learning technology among career and technical educators in Malaysia. The following are some suggestions for future studies in helping better understand the adoption and utilization of information and learning technology in Malaysia career and technical education systems:

1. More specific information should be gathered regarding personal computer ownership. Information experiences with the personal computer used at home such as web development, multimedia presentation, word

processing, surfing the internet, or playing games. This information would help us better understand faculty member's attitudes and behaviors.

2. Specific information about of faculty members' teaching area and workload of teaching, skills and attitudes toward information and learning technology should be gathered to better understanding their influences on attitudes and behaviors in adoption of information and learning technology as teaching tools. Furthermore, in-depth study that gathered faculty members' personality based that affect on their attitudes and behaviors toward adoption of information and learning technology.
3. The instrument used for gathered user satisfaction needs revision since it focuses on faculty member satisfaction with current information and learning technology available in the market. The questionnaire should focus more on faculty member satisfaction with information and learning technology available for them as teaching tools in the institution. In addition, user satisfaction can be use to predict job performance of faculty members.
4. Another study to explain and describe the probable cause of using the technology on job performance could be helpful. Findings by DeLone & McLean (1992) stated those users who are more satisfied with the technology will have greater level of impact on job performance.
5. Since the public career and technical institutions in Malaysia are administered by five different ministries, several studies need to be conducted in various career and technical institutions with different

support structures to investigate the impact of institutional support structures and organizational changes. The result will be greater understanding of the best institutional support environment in considering attitudes, behaviors, barriers and professional incentives for faculty members and students in adopting information and learning technology.

6. Qualitative research methods such as observations, interviews, and focus groups need to be conducted. This method provides greater insight into cognition, affect and intentions of faculty members that contribute to their attitudes and behaviors in regard to adopting information and learning technology. In addition, it will generate a grounded theory of adoption of information and learning technology among career and technical educators in Malaysia as well as identifying variables that requires further investigation.
7. Longitudinal studies to collect data over time could be conducted. This design will increase understanding of the process of adoption of information and learning technology among career and technical educators in Malaysia. The result will leads to the observed outcomes of adoption or rejection of the information and learning technology as teaching tools.

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APPENDIX A: COVER LETTER

Colorado State University
Knowledge to Go Places
School of Education

October 10, 2005

Dear Sir:

PARTICIPANT OF DIFFUSION OF INFORMATION AND LEARNING TECHNOLOGY AMONG CAREER AND TECHNICAL EDUCATORS STUDY

You have been selected as a very important person to complete this questionnaire with the title of 'Diffusion of Information and Learning Technology among Career and Technical Educators'. Enclosed is a copy of the questionnaire for the study. This questionnaire is a part of dissertation project of fulfillment of the requirements for the Degree of Doctor of Philosophy at Colorado State University.

2. This questionnaire is to gain an improved understanding of the relationship between the diffusion of information and learning technology with several predictors including self-reported knowledge, barriers to use, rate of important, institutional supports, and background information about the participants.

3. This study has been reviewed and approved by the Human Subject Committee of Regulatory Compliance Office at Colorado State University. This study also approved by Head of Director, Human Resources Department and CIAST Director. Your participation in this study is totally anonymous and confidential. The information provided will be used solely for the purpose of this study. By investing 15 to 20 minutes of your valuable time completing this questionnaire, you will make a major contribution to efforts to plan and improve using information and learning technology in Malaysia.

4. If you have any questions or need additional information regarding this study, please contact me at abdullah@lamar.colostate.edu or my advisor, Dr. Gene W. Gloeckner at gloeck@cahs.colostate.edu of School of Education, Colorado State University.

Again, I realized how valuable time is to busy people like you and therefore appreciate your response. Thank you for your participation and assistance in this study.

Sincerely,

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APPENDIX B: TRANSLATION OF COVER LETTER

Colorado State University
Knowledge to Go Places
School of Education

10 Oktober 2005

Tuan/Puan:

KAJIAN PENYEBARAN TEKNOLOGI MAKLUMAT DAN PEMBELAJARAN DI KALANGAN PENDIDIK BIDANG TEKNIKAL DAN KERJAYA

Anda dipilih untuk menyertai kajian yang bertajuk 'Penyebaran Teknologi Maklumat dan Pembelajaran di kalangan Pendidik Bidang Teknikal dan Kerjaya' di Malaysia. Bersama-sama ini disertakan soal selidik untuk tindakan anda. Soal selidik ini merupakan syarat memenuhi untuk mendapatkan Ijazah Doktor Falsafah di Colorado State University.

2. Soal selidik ini bertujuan meningkat dan mendalami pemahaman mengenai hubungan antara penyebaran teknologi maklumat dan pembelajaran dengan beberapa penjangka termasuk pengetahuan kendiri, penggunaan teknologi, halangan penggunaan, kepuasan pengguna, sokongan institusi, dan latar belakang pendidik.

3. Kajian ini telah disemak dan diluluskan oleh Human Subject Committee, Regulatory Compliance Office di Colorado State University. Kajian ini juga disokong oleh Ketua Pengarah, Jabatan Sumber Manusia (Kementerian Sumber Manusia) dan Pengarah CIAST. Penyelidik telah mengenal pasti segala risiko dan telah mengambil tindakan untuk mengurangkan risiko pasti dan yang mungkin timbul. Adalah dianggarkan bahawa soal selidik ini mengambil masa berharga anda selama 15 hingga 20 minit. Kajian ini tidak menawarkan faedah terus kepada anda tetapi diharapkan ia menyumbang kepada usaha untuk merancang dan memperbaiki penyebaran dan penggunaan teknologi maklumat dan pembelajaran di kalangan pendidik bidang kerjaya dan teknikal di Malaysia.

4. Penyertaan anda di dalam kajian ini adalah sukarela. Sekiranya anda menyertai kajian ini, anda pada bila-bila masa boleh menarik diri tanpa sebarang tindakan atau kerugian. Adalah mustahak diingatkan bahawa segala maklumat yang diperolehi dari kajian ini adalah sulit dan rahsia. Segala maklumat yang diberikan akan digunakan sepenuhnya untuk kajian ini sahaja.

5. Sekiranya anda mempunyai pertanyaan atau memerlukan maklumat lanjut mengenai kajian ini, sila hubungi saya di abdullah@lamar.colostate.edu atau penyelia saya, Dr. Gene W. Gloeckner di gloeck@cahs.colostate.edu dari School of Education, Colorado State University. Sebarang kemusykilan mengenai hak anda sebagai

sukarelawan dalam kajian ini boleh diajukan kepada Janell Meldrem, Human Research Administrator, Colorado State University di janell.meldrem@colostate.edu atau ditalian +1 970 491 1655.

Akhirnya, saya menghargai masa dan maklumbalas anda. Terima kasih kerana menyertai dan membantu dalam kajian ini.

Yang ikhlas,

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APPENDIX C: QUESTIONNAIRE

Colorado State University
Knowledge to Go Places
School of Education

Diffusion of Information and Learning Technology among Career and Technical Educators Questionnaire

For the purpose of this study, information and learning technology refers to any technology (hardware and software) use for the purpose of teaching and learning processes to achieve instructional objectives. In addition as set of tools or system that allows users to customize their access to information as they make decisions in an inquiry.

Section A. Self Reported Knowledge with Information and Learning Technology

Please indicate your degree of ***knowledge about/experience with*** the listed information and learning technology based on the following scale:

1	2	3	4	5
None	A little	Moderate	Good	Expert

	Information and Learning Technology	1	2	3	4	5
1.	Multimedia	○	○	○	○	○
2.	Distance learning	○	○	○	○	○
3.	Overhead projector	○	○	○	○	○
4.	Email	○	○	○	○	○
5.	WebCT	○	○	○	○	○
6.	Word possessing	○	○	○	○	○
7.	Spreadsheet software	○	○	○	○	○
8.	Database software	○	○	○	○	○
9.	Presentation software	○	○	○	○	○
10.	Computer networks (Internet or Intranet)	○	○	○	○	○
11.	Web authoring software	○	○	○	○	○
12..	Statistical computing	○	○	○	○	○
13.	Programming language	○	○	○	○	○

Section B. Usage of Information and Learning Technology

Please indicate how ***frequently you use*** of the listed information and learning technology in your current instructional practices based on the following scale:

1	2	3	4	5
Never	1 – 2 times per semester	Monthly	Weekly	Almost every class

	Usage of Information and Learning Technology	1	2	3	4	5
1.	Multimedia for in-class presentation	○	○	○	○	○
2.	Multimedia for student individualized learning	○	○	○	○	○
3.	Distance learning	○	○	○	○	○
4.	Computer assisted instruction	○	○	○	○	○
5.	Email: individualized contact with students	○	○	○	○	○
6.	Email: communication with on and off-campus colleagues	○	○	○	○	○
7.	Class over WebCT to promote class discussion	○	○	○	○	○
8.	Electronic lists for discussions with colleagues	○	○	○	○	○
9.	Word processing to prepare exams, class materials	○	○	○	○	○
10.	Computer spreadsheet to analyze grades, records	○	○	○	○	○
11.	Computer database to manage records	○	○	○	○	○
12.	Presentation software to prepare handouts, transparencies	○	○	○	○	○
13.	Internet: information retrieval via World Wide Web, ERIC, ftp, etc	○	○	○	○	○
14.	Internet: web based course	○	○	○	○	○
15.	Statistical computing to enter, analyze, and manipulate data	○	○	○	○	○
16.	Programming language to designed for scientific, engineering, and other applications for class materials	○	○	○	○	○

Section C. User Satisfaction

Please rate the ***satisfaction*** of each of the following factor of using or experience with the information and learning technology in your current instructional practices.

1	2	3	4	5
Strongly Disatisfy	Disatisfy	Satisfy	Very Satisfy	Strongly Satisfy

	Satisfaction	1	2	3	4	5
1.	Ease of use	○	○	○	○	○
2.	Clear advantages over traditional delivery	○	○	○	○	○
3.	Compatibility with existing materials	○	○	○	○	○
4.	Compatibility with discipline	○	○	○	○	○
5.	Increased student interest	○	○	○	○	○
6.	Improved transfer knowledge and student learning	○	○	○	○	○
7.	Time needed how to learn it	○	○	○	○	○
8.	Personal comfort level with technology	○	○	○	○	○

Section D. Barrier to Use

Please rate the ***importance*** of each of the following barriers to use of information and learning technology in your current instructional practices.

1	2	3	4	5
Not Important	Somewhat Important	Important	Very Important	Vitally Important

	Barrier to Use	1	2	3	4	5
1.	Lack of time to learn	○	○	○	○	○
2.	Lack of self-interest	○	○	○	○	○
3.	Incompatible or irrelevance to my discipline	○	○	○	○	○
4.	Does not contribution to my professional advancement	○	○	○	○	○
5.	Difficulty to access equipment	○	○	○	○	○
6.	Lack of training	○	○	○	○	○

Section E Institutional Support

Please indicate a score based on the ***degree of support*** of using or experience with the information and learning technology in your current instructional practices.

1	2	3	4	5
Not Supportive	Somewhat Supportive	Supportive	Very Supportive	Strongly Supportive

	Institutional Support	1	2	3	4	5
1.	Administrative support	○	○	○	○	○
2.	Equipment availability	○	○	○	○	○
3.	Funds for necessary materials	○	○	○	○	○
4.	Training for faculty in information and learning technology use	○	○	○	○	○
5.	Information on materials available in discipline	○	○	○	○	○

Section F. Background Information

This information is requested to gain a better understanding of the population being studied.

1. Years of teaching _____years
2. Gender
   - ☐ Male
   - ☐ Female
3. I own a personal computer in my residence
   - ☐ Yes
   - ☐ No

APPENDIX D: TRANSLATION OF QUESTIONNAIRE

Colorado State University
Knowledge to Go Places
School of Education

Penyebaran Teknololgi Maklumat dan Pembelajaran dikalangan Pendidik Bidang Teknikal dan Kerjaya

Teknologi maklumat dan pembelajaran dalam kajian ini merujuk kepada mana-mana teknologi (perkakasan dan perisian) digunakan untuk mencapai objektif proses pengajaran dan pembelajaran. Ia juga sebagai alat atau sistem yang membolehkan pengguna mengolah maklumat ketika mereka membuat keputusan untuk tujuan pengajaran.

Bahagian A. Pengetahuan Kendiri dengan Teknologi Maklumat dan Pembelajaran

Sila tandakan darjah ***pengetahuan mengenai/penglaman dengan*** teknologi maklumat dan pembelajaran berdasarkan skala berikut:

1	2	3	4	5
Tiada	Sedikit	Sederhana	Baik	Cemerlang

	Teknologi Maklumat dan Pembelajaran	1	2	3	4	5
1.	Multimedia	○	○	○	○	○
2.	Pendidikan jarak jauh	○	○	○	○	○
3.	Pengunjur pembesar (OHP)	○	○	○	○	○
4.	Email	○	○	○	○	○
5.	WebCT	○	○	○	○	○
6.	Pemprosesan perkataan	○	○	○	○	○
7.	Perisian hamparan elektronik	○	○	○	○	○
8.	Perisian pengkalan data	○	○	○	○	○
9.	Perisian pembentangan	○	○	○	○	○
10.	Rangkaian komputer (Internet atau Intranet)	○	○	○	○	○
11.	Perisian pengarangan web	○	○	○	○	○
12..	Pengkomputeran statistic	○	○	○	○	○
13.	Bahasa pengaturcaraan	○	○	○	○	○

Bahagian B. Pengggunaan Teknologi Maklumat dan Pembelajaran

Sila nyatakan bagaimana ***kekerapan anda menggunakan*** teknologi maklumat dan pembelajaran berikut di dalam pengajaran berdasarkan skala berikut:

1	2	3	4	5
Tiada	1 – 2 kali semester	Bulanan	Mingguan	Hampir setiap kelas

	Penggunaan Teknologi Maklumat dan Pembelajaran	1	2	3	4	5
1.	Multimedia untuk pembentangan di dalam kelas	○	○	○	○	○
2.	Multimedia untuk pengukuhan pelajar	○	○	○	○	○
3.	Pendidikan jarak jauh	○	○	○	○	○
4.	Pembelajaran berbantu komputer	○	○	○	○	○
5.	Email: berhubung secara individu dengan pelajar	○	○	○	○	○
6.	Email: berhubung dengan rakan sejawat di dalam dan di luar kampus	○	○	○	○	○
7.	Kelas khas persidangan komputer/papan buletin untuk menggalakan perbincangan pelajar	○	○	○	○	○
8.	Senarai elektronik untuk berbincang dengan rakan sejawat	○	○	○	○	○
9.	Pemproses perkataan untuk menyediakan kertas peperiksaan, nota	○	○	○	○	○
10.	Perisian hamparan kera untuk menganalisa markah, rekod	○	○	○	○	○
11.	Pengkalan data untuk menguruskan rekod	○	○	○	○	○
12.	Perisian pembentangan untuk menyediakan nota edaran, transperansi	○	○	○	○	○
13.	Internet: mendapatkan maklumat melalui web, ERIC, dan sebagainya	○	○	○	○	○
14.	Internet: kursus berasaskan web	○	○	○	○	○
15.	Perisian statistic untuk memasukkan, analisis, dan manipulasi data	○	○	○	○	○
16.	Bahasa pengaturcaraan untuk merekabentuk aplikasi saintifik, kejuruteraan atau lain bagi bahan pengajaran kelas	○	○	○	○	○

Bahagian C. Kepuasan Pengguna

Sila nyatakan ***kepuasan*** penggunaan atau pengalaman dengan teknologi maklumat dan pembelajaran berikut di dalam pengajaran anda.

1	2	3	4	5
Sangat Tidak Puas-hati	Tidak Puas-hati	Puas-hati	Sangat Puas-hati	Sangat Sungguh Puas-hati

	Kepuasan	1	2	3	4	5
1.	Mudah digunakan	○	○	○	○	○
2.	Jelas kelebihannya berbanding pengajaran cara lama	○	○	○	○	○
3.	Keserasian dengan bahan sedia ada	○	○	○	○	○
4.	Keserasian dengan bidang pengajaran	○	○	○	○	○
5.	Menarik minat pelajar	○	○	○	○	○
6.	Membaiki pemindahan pengetahuan dan pembelajaran kepada pelajar	○	○	○	○	○
7.	Masa diperuntukkan mempelajari teknologi maklumat dan pembelajaran	○	○	○	○	○
8.	Aras keselesaan peribadi dengan teknologi	○	○	○	○	○

Bahagian D. Halangan kepada Penggunaan

Sila nyatakan ***kepentingan*** setiap halangan kepada penggunaan teknologi maklumat dan pembelajaran di dalam pengajaran

1	2	3	4	5
Tidak Penting	Sedikit Penting	Penting	Sangat Penting	Sungguh Sangat Penting

	Halangan kepada Penggunaan	1	2	3	4	5
1.	Masa untuk mempelajari menggunakan teknologi maklumat dan pembelajaran	○	○	○	○	○
2.	Minat	○	○	○	○	○
3.	Tidak sesuai dengan bidang pengajaran	○	○	○	○	○
4.	Menyumbang kepada kemajuan kerjaya	○	○	○	○	○
5.	Peralatan teknologi maklumat dan pembelajaran mudah didapati	○	○	○	○	○

	Halangan kepada Penggunaan	1	2	3	4	5
6.	Latihan	○	○	○	○	○

Bahagian E Sokongan Institusi

Sila nyatakan ***darjah sokongan*** penggunaan atau pengalaman dengan teknologi maklumat dan pembelajaran di dalam pengajaran anda.

1	2	3	4	5
Tiada Sokongan	Sedikit Sokongan	Sokong	Sangat Menyokong	Sungguh Sangat Menyokong

	Sokongan Institusi	1	2	3	4	5
1.	Sokongan pentadbiran	○	○	○	○	○
2.	Peralatan mudah didapati	○	○	○	○	○
3.	Bantuan kewangan untuk bahan	○	○	○	○	○
4.	Latihan untuk tenaga pengajar di dalam menggunakan teknologi maklumat dan pembelajaran	○	○	○	○	○
5.	Mempunyai maklumat mengenai bahan pengajaran di dalam bidang pengajaran	○	○	○	○	○

Bahagian F. Maklumat Latarbelakang

Maklumat ini diperlukan untuk lebih memahami mengenai populasi kajian.

1.	Lama mengajar	____ tahun
2.	Jantina	☐ Lelaki
		☐ Perempuan
3.	Miliki komputer peribadi di tempat tinggal	☐ Ya
		☐ Tidak

APPENDIX E: LETTER OF APPROVAL FROM CIAST

PUSAT LATIHAN PENGAJAR DAN KEMAHIRAN LANJUTAN (CIAST)
JABATAN TENAGA MANUSIA
KEMENTERIAN SUMBER MANUSIA

MS ISO 9001:2000

Surat Kami : PLPKL/SA/10/05 Jld.21(56)

Surat Tuan :

Tarikh : 12 April, 2005

Mr. Abdullah Mat Rashid,
4313 Rivert Ct.
Fort Collins, CO 80525
USA

Dear Mr. Abdullah,

RESEARCH STUDY OF DIFFUSION OF INFORMATION AND LEARNING TECHNOLOGY: EXPLORING THE CONSEQUENCES AMONG CAREER AND TECHNICAL EDUCATORS IN MALAYSIA

With reference to your letter of March 10th, 2005, we are pleased to inform you that your request to carry out the research survey has been approved.

2. We have understood the extent of the survey that you will be carrying out with regards to the sampling techniques involved, the human research subjects, and the voluntary nature of the survey. However, it is emphasized that during and after the course of your survey, you shall adequately protect and uphold the privacy and confidentiality of any personal information related to the individuals to be involved.

3. We will assist you in providing the necessary databases for sampling, and also to stage a briefing session prior to the survey. In view of the local situation, I strongly suggest that the questionnaire be translated in order to provide better understanding and gain relevant response.

Kindly contact our office further for detailed arrangement.

Thank you.

Yours Sincerely,

NIZAM KAMARULZAMAN
Director of CIAST
Manpower Department,
Ministry of Human Resources, Malaysia.

NK/norshidy/Oktober 2005

1

PETI SURAT 7012, SEKSYEN 19, 40900 SHAH ALAM, SELANGOR DARUL EHSAN
No. Tel. : 03-55415736/39 No. Fax : 03-55414807 (Latihan/Pentadbiran) 03-55411508 (Pengarah)
E-Mail : help@ciast.gov.my Homepage :www.ciast.gov.my

Cc Director-General,
Manpower Department,
Ministry of Human Resources, Malaysia
Level 6, Block D4, Parcel D,
Federal Government Administrative Centre,
62502 Putrajaya
MALAYSIA

Director,
Human Resource Skills Division,
Manpower Department,
Ministry of Human Resources, Malaysia
Level 6, Block D4, Parcel D,
Federal Government Administrative Centre,
62502 Putrajaya
MALAYSIA

Gene W. Gloeckner, PhD
241 Education Building,
Colorado State University,
Fort Collins, CO 80523-1588
USA

APPENDIX F: NOTICE OF APPROVAL FROM REGULATORY COMPLIANCE OFFICE

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
and Information Technology
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: (970) 491-2293

Notice of Approval for Human Research

Principal Investigator: Gene Gloeckner, School of Education, 1588
Co-Principal Investigator: Abdullah Mat Rashid, School of Education, 1588

Title: Diffusion of Information and Learning Technology among Career and Technical Educators in Malaysia

Protocol #: 05-250H **Funding Source:** N/A
Number approved: 160 participants
Committee Action: **Approved on:** October 3, 2005 **Expires:** September 16, 2006

HRC Administrator: Janell Meldrem

Consent Process:
Because of the nature of this research, it will not be necessary to obtain a signed consent form. However, all subjects must receive a copy of the approved cover letter printed on department letterhead. The requirement of documentation of a consent form is waived under § __.117(c)(2).

Investigator Responsibilities:

- It is the PI's responsibility to obtain this consent from all subjects.
- It is the responsibility of the PI to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research.
- It is also the PI's responsibility to notify the Committee of any changes in experimental design, participant population, consent procedures or documents. This can be done with a memo describing the changes and submitting any altered documents.
- Students serving as Co-Principal Investigators must obtain PI approval for any changes prior to submitting the proposed changes to the HRC for review and approval.
- The PI is ultimately responsible for the conduct of the project.
- A status report of this project will be required within a 12-month period from the date of review. Renewal is the PI's responsibility, but as a courtesy, a reminder will be sent approximately two months before the protocol expires. The PI will be asked to report on the numbers of subjects who have participated this year and project-to-date, problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary continuation form (H-101) is available from the RCO web page www.research.colostate.edu/rcoweb/.
- Upon completion of the project, an H-101 should be submitted as a close-out report.
- If approval did not accompany a proposal when it was submitted to a sponsor, it is the PI's responsibility to provide the sponsor with the approval notice. This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647.
- Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

Please direct any questions about the Committee's action on this project to me for routing to the Committee. Additional information is available from the Regulatory Compliance web site at http://www.research.colostate.edu/rcoweb/.

Attachment to PI & Co-PI

Date of Correspondence: 10/25/05