AN INTEGRATED VIEW OF COGNITIVE ABSORPTION IN A TECHNOLOGY-MEDIATED LEARNING ENVIRONMENT

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ABSTRACT

An Integrated View of Cognitive Absorption in A Technology-Mediated Learning Environment

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Organizations today allocate a significant amount of their budget in information technologies dedicated to improve their learning/training processes capabilities. While there has been a wealth of empirical research on technology-mediated learning/training, most tend to focus on instrumental beliefs as drivers of individual intention toward information technologies. However, in recent years, more and more researchers advocate the influence of individuals' holistic experience with the learning systems and associated intrinsic motivational drivers on intentions and acceptance.

The present study is motivated by the need for a better understanding of cognitive absorption as an intrinsic motivational driver to use technology-mediated learning systems. To that effect, the present study proposes an integrated research model based on the theory or reasoned action, theory of planned behavior and the technology acceptance model, to empirically investigate the impact of cognitive absorption on the belief-intention structure of individuals' behavior.

A web-survey was administered to 105 students after they have used a multimedia learning environment that aimed to help them study for an online course. Results suggest that individual technology acceptance behavior is a function of their holistic experience with the technology and cognitive perceptions formed by rational assessments and these impacts are mediated by individuals' attitude toward the technology. The study offers a motivation perspective to the technology adoption research, and provides empirical support on predictors of individual behavior towards the use of multimedia learning systems in higher education. Findings provide insight to the implementation of multimedia learning and information system design.

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INTRODUCTION

It is evident today that the use of information technologies (IT) has significant impacts on every aspect of our lives. In the context of the education industry more and more higher education institutions have come to realize the potential impact of using IT in the classroom as part of the learning environment. Many terms have been interchangeably used to refer to this type of learning environment such as e-learning, computer-enhanced learning, technology-mediated learning and computer-assisted instructions. An overview of e-learning and how it is being implemented using content management systems is provided by Cohen and Nycz (2005). Despite the many challenges yet to be overcome, the advantages of e-learning have been widely recognized. Some of these major advantages include flexibility and broader accessibility (Lee et al., 2005), improved students' performance (Alavi, 1994), reflective evaluation of the learning experience (Hiltz, 1995), and higher computer self-efficacy (Piccoli et al., 2001). Academic institutions also benefit greatly from it in terms of cost reductions and increasing revenues (Saadé & Bahli, 2005). Researchers and practitioners have suggested that the 'current' of technologically driven change will pervade in the education industry.

The success of the technology-mediated learning system is primarily due to its potential to integrate various types of content sources (such as sound, video, graphics, text, etc…) and delivered in various forms (such as collaboration, interactive, simulation, etc…) as well as applications of different instructional strategies (such as objectivism, constructivism, and collaborativism). Many universities are now beginning to develop and deliver their programs through such types of systems. At the same time, studies done on the technology-mediated learning system have mainly focused on determining how to use Internet-based tools/objects to support instruction, to assess user satisfaction (Wang, 2003), and to characterize the Internet-based-learning student (Lu et al., 2003; Skadberg & Kimmel, 2004), as well as learning effectiveness (Piccoli et al., 2001). Some studies have only recently examined the development and design of learning objects and their effectiveness in demonstrating that learning did occur (Salas & Ellis, 2006).

In this thesis, the technology-mediated learning (TML) is defined as "an environment in which the learner's interactions with learning materials (readings, assignments, exercises, etc.), peers and/or instructors are mediated through advanced information technologies... broadly referring to computing, communication, and data management technologies, and their convergence" (Alavi & Leidner, 2001). At the beginning of this study, we review the evolvement of TML while information technologies and telecommunication networks have continuously extended its dimensions. Indeed, we present how educators embed more effective instructional strategies in TML by taking advantage of IT. A review of the state of current TML research is also presented at this part of this study. At the second part, we discuss the models and theories that have applied to investigate individual behaviors towards IT usage. Especially, we review the empirical studies with motivation perspective and underscore the importance of intrinsic motivators while there is an increasing attention to these non-instrumental variables since the development of IT makes individual interaction with the technology become an riveting and engaging experience (Agarwal & Karahanna, 2000). Later, we propose a conceptual model that identifies the primary predictors of individual TML acceptance behavior. In order to empirically examine the relationships hypothesized in the model, a web-survey of 105 students who used a TML available at a large Canadian university was conducted. We found out that our conceptual model has significant ability to predict system user behavior and has identified that the acceptance behavior is a function of two parallel cognitive mechanisms in terms of intrinsic motivation and belief-intention models. In addition, this study sheds light on the research about the mediation role of attitude and importance of social factors to technology use.

This study contributes to current technology adoption literature, especially on TML, by delineating the formulation of individual acceptance behavior with motivation perspective. In addition, this research provides an empirically validated model for the future investigation on behavior predictors under TML context. Furthermore, it adds to system design and development study by highlighting the positive outcomes associated with the use of hedonistic elements in the system. The immediate findings of our study provide insightful recommendations to organizations considering the implementation of technology-mediated learning systems and the performance improvement on technology-mediated programs.

This thesis is organized as follows. In the next chapter, we review the literature on TML to state our research questions. We then delineate the theoretical background of our conceptual model, and develop the study hypotheses, followed by a description of the research design. Data analysis and discussion of the results, the study limitations, implications for research and practice as well as conclusions follow.

1 TECHNOLOGY MEDIATED LEARNING (TML) ENVIRONMENT

This section deeply reviews the literature that is relevant to the technology-mediated learning environment. Specifically, it includes the concepts of TML at its each generation, instructional strategies embedded in TML and information technologies used to facilitate TML. Last, there is a discussion about the state of TML research, which leads to our research aims.

Higher education institutions and corporate training facilities have been investing in information technologies to improve education and training. The information and communication technologies have become an integral part of the teaching and learning processes. However, research on technology-mediated learning lags behind developments and applications in practice (Alavi & Leidner, 2001).

1.1 What is the technology-mediated learning environment?

Information system (IS) scholars have began their theoretical grounded and rigorous research on technology-mediated learning environments since the 1990s (Alavi & Leidner, 2001). The rapid development of information and communication technologies has advanced the platform of the environments during the last decade. Consequently, the target systems and concepts of technology-mediated environment have evolved with the pace of information technology development in previous studies, while dimensions of the definition of learning environment have expanded from traditional terms of time, place, and space to a broader range of dimensions (Leidner & Fuller, 1997; Piccoli et al., 2001).

The first generation of IT-mediated environment was characterized by the use of a single technology to facilitate presentation and give control of learning process to learners, as well as serve as reliable and consistent delivery sources of course materials. The role of IT is a means of performing routine, operational learning tasks structured in instructional methods to replace manual operations in traditional settings, such as computer-based drill-and-practice (Clark, 1991), and simulations (Beech, 1983). The empirical findings are inconsistent, but positive outcomes are generally shown in researches (Alavi & Leidner, 2001).

Distance learning represents the second generation of technology-mediated learning environment. It breaks the limitations of prior approach to education delivery in terms of time, place and space (Volery & Lord, 2000). When researchers (Alavi et al., 1995; Alavi et al., 1997; Webster & Hackley, 1997) observed the profound outcomes on this learning mechanism, they shared the conception that a typical distance learning implementation may utilize information to provide audio, video, and graphic links between two or more sites, therefore using multimedia for communication. It involves more than one medium for the organization, information exchange, and interactive aspects of learning experience. Keegan (1990) specifically elaborated five basic elements of distance education: the separation of teacher and learner; the influence of an educational organization; the use of technical media to unite the teacher and learner and to carry educational content; the provision of two-way communication so that the student may benefit from or even initiate dialogue; and the possibility of occasional meetings for both didactic and socialization purposes. IT provides a collaborative, geographically and temporally extended leaning environment, where students and instructors located at different places have multiple and dynamic communications flows to exchange knowledge, faculty expertise and student perspectives with access of asynchronous or synchronous groupware technology (Alavi et al., 1997; Carswell & Venkatesh, 2002).

The Internet, World Wide Web and web-based technologies are essentials of the most recent technology-mediated learning environment. In recent studies, it refers to virtual learning environment (VLE) that a web-based communications platform that allows students, without limitation of time and place, to access different learning tools, such as program information, course content, teacher assistance, discussion boards, document sharing systems, and learning resources (Martins & Kellermanns, 2004; Ngai et al., 2007; Piccoli et al., 2001; Raaij & Schepers, 2006). VLEs share many similarities with prior technology-mediated learning environments, but its concept is broader. Specifically, Piccoli et al (2001) added another three dimensions in terms of technology, interaction, and control to the definition of a learning environment to elaborate how a VLE differs from traditional learning settings. VLE takes advantages of network infrastructure to deliver learning materials in various formats, such as streaming audio and video, computer animations and stimulation (Saadé & Bahli, 2005), to create learning communities (Wilson, 1996) and facilitate many-to-many communication relations among learners and with instructors (Choi et al., 2006). In addition, learners have a high degree of learning control on the pace and sequence of material and the time and place of their study even during instruction as well (Piccoli et al., 2001). VLE provides an opportunity to restructure the learning experience. For example, students can watch a lecture with integrated instructional video, related hypertext, slides and class notes. The e-learning system automatically presents study materials in a same topic. Learners can perform interactive operations such as referring related hypertext, replaying specific parts of video clips, to manage the learning pace and personalize knowledge acquisition process (Zhang et al., 2006).

1.2 Paradigm of instructional strategy in IT mediated learning

Pedagogical researchers suggest that although there is no single or unified learning theory, several effective learning forms can be readily identified in terms of learning from instruction, learning by doing, vicarious learning, and learning via problem solving in daily life (Alavi, 1994; Alavi & Leidner, 2001). Specifically, learning from instruction embodies the kernel of virtual learning environments in the context of postsecondary educational environment. Learning from instruction refers to situations where the learning process of individuals follows the instructional method structured in the learning environment in such a way that the learners will achieve a desired outcome (Shuell & Lee., 1976). Some researchers support that "if learning occurs as a result of exposure to any media, the learning is caused by the instructional method embedded in the media presentation." (Clark, 1994, p. 26) Instructional method refers to means and models for presenting, sequencing, and synthesizing subject-matter content (Reigeluth et al., 1994). Technology enhances capabilities for the execution of instructional strategies or methods via new formats of content presentations or instructional events (Alavi & Leidner, 2001). For example, Alavi (1994) introduced a group decision support system (GDSS) to teach three core courses in management information systems of a MBA program. A collaborative learning technique named Student Team-Achievement Division (STAD) developed by Slavin (1987) was applied to the classes. The GDSS facilitated the study group's process support, a cooperation mechanism, through an electronic communication infrastructure (electronic messaging capabilities obtained through a local area network), enabled by tools of brainstorming, comment cards, compactor, etc. Students used these tools to cooperate with their teammates to complete case analysis. For instance, a student group opened a dialog and then used the brain writing tool to generate ideas and rating tool to rate the quality of these ideas provided by the GDSS. In addition, the dialog featured a comment card tool that was employed by the group to elaborate on and refined the three most highly rated ideas. The learning outcomes of students who studied in the GDSS-enabled environment were significantly superior to the learning outcomes of students who learned in a traditional environment with same teaching technique. In this learning situation, the two important features of STAD technique in terms of positive interdependence and individual student accountability were magnified by synchronous information sharing and analytical capabilities of GDSS technology otherwise unlikely to available to learners even using the same collaborative method.

Leidner and Jarvenpaa (1995) clearly delineated five theoretical models of learning: objectivism, constructivism, collaborativism, cognitive information processing, and socioculturism and listed essentials of each learning models that clarify how each instructional strategy differs from others.

From a methodological standpoint, an explicated acknowledgement of the learning model is very critical to explain the effectiveness of instruction. The core formulation of learning process is an implicit or explicit learning model (Leidner & Jarvenpaa, 1995). In traditional settings, proponents of objectivism represent and transfer the objective reality, knowledge, to learners with selective reinforcement in order to make a change in the behavioral disposition of an organism or modify behavior corresponding to the reality (Jonassen, 1993). Associated with these assumptions, computer-assisted instruction (CAI) and computer-based training (CBT) automate the learning activities. Consequently, learners learn more effectively and efficiently when they are in control of the pace and have high active involvement (Leidner & Jarvenpaa, 1995). Conversely, constructivism argues that the external reality does not exist independently, but constructed either socially or by individuals (Jonassen, 1993). Therefore, the learning to individuals is a process to create their own, unique conception of the reality but rather to reproduce it (O'Loughlin, 1992). The role of teachers shifts from the instructor to the creative mediator of the process (Leidner & Jarvenpaa, 1995). In fact, King et al (1990) observed that when students had access to publicly available financial information via computers, they would significantly outperform the counterparts who are without access to such information in case analyses. The model of collaborativism is a derivation of the constructivism. It assumes that learning comes from learners' interactions with others (Slavin, 1990) and the different understandings contribute to a new, shared knowledge (Whipple, 1987). Learners take advantages of information technologies to facilitate maximal information and knowledge sharing. In consequence, studies found collaborative learning leads to higher levels of perceived skill development, self-reported learning, learning interests and evaluation of classroom experience (Alavi, 1994). In addition, learners tend to generate higher levels of interest in learning and perceived learning (Leidner & Fuller, 1997).

From a practical perspective, the models influence the design of a learning environment and ultimately its effectiveness (Piccoli et al., 2001). Learning models need to access appropriate hardware and software to support their assumptions with quality and reliability. For example, with objectivism, instructors stand the peak of knowledge hierarchy and control the learning process. Students are expected to be instructed and told how to apply knowledge. The automation technologies such as CAI enhance the efficient of knowledge transfer but leave "the processing of the knowledge by students as well as the creation of knowledge by instructors unchanged" (Leidner & Jarvenpaa, 1995, p. 283). Consequently, the learning outcome of this alignment is an ephemeral effect on self-variables such as motivation, interests and self-efficacy (Leidner & Jarvenpaa, 1995). In recent years, the development of network infrastructure and enhanced performance of virtual learning software strategically fits the shift in learning paradigms from "teaching" to "learning" which aims to achieve learning through collaborative actions, and self-control process without geographical and time limitations (Choi et al., 2006).

1.3 Information technologies

In the view of technology, a wide range of information and communication technologies has been employed to support instructional strategies and facilitate the corresponding activation (Alavi & Leidner, 2001). Generally, CAI, CBT and stand-alone computers are major players in the initial phase of IT-enabled learning environment. In an early study (Hiltz, 1986), the teleconferencing system is used to create an electronic analogue of the traditional classroom learning environment. Every student participate class activities with support of combination software at various points. And also an innovative procedure of the role-playing game was used to help students perform their learning. Technologies are used to encourage participation and transmit knowledge in an efficient method, and the learners are still instructed by teachers who remain the nucleus of the class (Leidner & Jarvenpaa, 1995).

During 1990s, active synchronous and asynchronous learning systems are widely used to promote multiple-way communications in education with support from interactive technologies (Alavi, 1994; Alavi et al., 1995; Alavi et al., 1997; Leidner & Fuller, 1997; Storck & Sproull, 1995; Webster & Hackley, 1997). Systems facilitate communications between learners and instructors in real time and support out-of-class knowledge sharing activities. For example, two US universities located in different areas were involved a project of using the IT platform to delivery an MBA course in the information systems area. In the class session, instructors use videoconferencing to present and lead discussions at both sites simultaneously; students at both sites can ask questions verbally or via group support system software. With networked workstations, students share their perspectives, "brainstorm ideas, organize information, and observe the degree of consensus between the two classrooms", and then "achieve the distance collaborative learning" (Alavi et al., 1997, p. 1316). After the class time, students from each side arrange project groups and collaborate on projects through an asynchronous groupware. Information technologies enable this flexible, student-centered and collaborative learning environment.

In recent years, web-based virtual learning space has increasingly become the mainstream of learning environment applied in education. This type of IT-enabled system integrates a wide range of interactive technologies such as chat forum, interactive video/audio, instant message, hyperlinks, groupware, and the assessment of individual students or group of students and the provision of administrative and student support with a full use of Internet (Choi et al., 2006). Students can access learning materials instructionally embedded in the online teaching modules grouped in tutorials (Piccoli et al., 2001). Under this environment, students become more independent on their learning process since each teaching module is accessible and cross-linked materials help students to instantaneously retrieve information as they are confronted with problems; also they gain broader freedom on collaboration and communications between classmates and with instructors. In this way, technologies transform physical learning settings to digital learning space leading to (1) the role shift of instructors (2) a continuous time-independent process (3) multi-level, multi-speed knowledge creation (Leidner & Jarvenpaa, 1995).

1.4 The state of TML research

Previous research on technology-mediated learning environment probably could be divided into three categories: first, a major concern is on learning effectiveness and outcomes comparison between traditional settings and IT-enabled environment. The second group of studies, initiated in recent years, is focused on determinants which have positive influence on the e-learner's satisfaction or performance and impact the success of a specified TML system. The latest school of research investigates predictors of users' acceptance behavior towards TML (see Appendix E).

Compared to face-to-face or classroom instruction, whether or not IT-enabled learning environment can enhance users' learning effectiveness and study performance has been a basic question in TML research. The results had mixed conclusions: findings of Alavi (1994) suggest a significant difference in learning outcomes whereas Wetzel et al. (1994) observe that comparative studies of IT-enabled and traditional learning show "no statistically significant difference". However, while more and more comparative studies have been conducted, the discrepancy has been diminishing; invariably, they summarize findings to a fact that people achieve the same levels of performance in IT-enabled learning environment as they do in various other forms of instruction (Alavi et al., 1995; Alavi et al., 1997; Haynes & Dillon, 1992; Johnson et al., 2000; Machtmes & Asher, 2000; Piccoli et al., 2001; Russell, 1999; Smith et al., 2000; Storck & Sproull, 1995).

Beside performance comparison, IS researchers also have investigated the impact of IT on consequences of different instructional methods and learning outcomes in TML. A substantial amount of research attention have addressed the questions of collaborative learning facilitated by GDSS (Alavi & Leidner, 2001). Alavi (1994) found that GDSS-supported collaborative learning makes students significantly outperformed than their non-supported counterparts. Findings from another study (Lim et al., 1997) suggest that co-discovery (a form of collaborative learning) students generated more and deeper level utterances and thinking. Furthermore, the belonging of "learning communities" facilitated by the system motivates students to work hard and to keep up with the contributions of instructors and classmates (Hiltz & Wellman, 1997). In fact, these findings advocate the belief that collaboration and participation improve learning because of their mediation on socio-emotional variables and affection on cognitive processes (Alavi & Leidner, 2001). In addition, research has considered the outcomes of derivations of collaborative learning and other instructional methods. Piccoli et al (2001) studied the virtual learning environment and found that it can leads to higher computer self-efficacy while participants report being less satisfied with the learning process. Co-discovery students formulated mental models that provided grater inference potential, which leads to a better performance on a novel task (Lim et al., 1997). With high level of interactive control, students have better learning performance and use satisfaction than those of other groups (Zhang et al., 2006). Leidner and Fuller (1997) found that students involved IT-enabled collaborative learning have higher levels of interest in learning and their levels of perceived learning raise after the first use. Students positively evaluate their learning experience in a virtual e-learning environment (Alavi et al., 1997). Some research also investigated the use of TML for organizational learning. Goodman and Darr (1998) observed that regional computer-aided communities have better performance on organizational learning and the characteristics of virtual communities facilitate proceeding of regionally specific problems. In another research, Alavi et al (2002) assessed learning outcomes of two distributed learning environments varying hierarchical characteristics. They concluded that the advance technology figures do not generate higher learning performance, but can change the aims of their communication.

Furthermore, researchers observed the importance of the characteristics of learners and the role of instructors on e-learning applications. In an early study, Leidner and Jarvenpaa (1993) investigated several new computer-based technologies in use including interactive guided learning, real-time manipulation of data, a flexible learning lab and a display mechanism with student. And they found that teacher styles and student preference are two important moderators of teaching methods and their effects. Webster and Hackley. (1997) conducted a research on synchronous learning technology, videoconferencing system, and suggested that the greater the number of locations, the greater the process losses. Student's comfort with image on screen and teaching style affect their participation and involvement. In a "virtual classroom", only informed and motivated learners can fully benefit the increased learner control (Hiltz, 1986). This has its root in research suggesting that instructional designs should be created that provide personalized pedagogical options for student corresponding to the students' learning style (Alavi & Leidner, 2001; Lengnick-Hall & Sanders, 1997).

In the second school of study, IS researchers have developed assessment measures of TML outcomes and explored factors that may influence these outcomes. Webster and Hackley (1997) delineated an initial conceptualization of primary technology-mediated distance learning outcomes relating to teaching effectiveness (e.g. technology self-efficacy, attitude toward the technology). And they reported that reliability and quality of the technology, instructors' attitude, interactive teaching style and instructor control of the technology would positively influence learning outcomes in a synchronous environment. Wang (2003) developed a measurement of e-learning satisfaction with asynchronous systems in terms of learner interface, learning community, content and personalization. Carswell and Venkatesh (2002) conducted a research exclusively in an asynchronous distance education environment using the technology planned behavior and diffusion of innovation theory. Attitude, social norm, relative advantage, visibility and compatibility are influential factors of e-learning outcomes in terms of acceptance, learning and future outcome. For a web-based educational environment, characteristics of technology, the instructor, and the pervious use of the technology form a student's perspective are identified by (Volery & Lord, 2000) as critical success factors in online delivery. Choi et al (2006) revealed that a positive holistic experience, flow, plays a critical role to impact learning outcomes directly and indirectly. In a recent study, Piccoli et al (2001) developed a broad framework identifying the theoretical determinates of learning effectiveness. They grouped determinates into two classes: human dimension and design dimension from previous research in technology-mediated education. The human dimension includes characteristics of students such as pervious experience, technology comfort, and the profile of teachers (e.g. teaching style, technology attitudes). The design dimension includes learning model, technology, learner control, content and interaction. This framework organizes the TML research domain and addresses the relationship between the main constructs.

In consistent with prior IS research, the interest of exploring determinants of users' acceptance behavior toward e-learning system leads to many empirical studies. The technology acceptance model dominates the research across forms of the system (e.g. asynchronous e-learning system, web-based system), subjects (e.g. students and employees) and cultures (e.g. Americans, Chinese and Arabic)(Lee et al., 2005; Ngai et al., 2007; Ong et al., 2004; Raaij & Schepers, 2006; Saadé & Bahli, 2005; Selim, 2003; Toral et al., 2006). Also each of the studies tended to highlight different factors from external environment that are related to the use or acceptance of virtual learning environment. Indeed, IS has seen the study of various other models or theories, such as the Theory of Reasoned Action, Theory of Planned Behavior, Diffusion of Innovation theory, intrinsic motivation, flow theory and fairness theory. That is, the existing research is fragmented in terms of findings and the conceptual approaches. While each has contributed to our cumulative knowledge, and explained a part of the adoption decision, no single study has tested a model of the IT mediated learning system that incorporates constructs which simultaneously address both of the affective/holistic dimension and rational/analytical dimension. Research that investigates and empirically validates a comprehensive model with a state-of-the-art technology-mediated learning system is clearly required.

2 THEORETICAL BACKGROUNDS

This section reviews the theories and models applied in previous research about individual behavior towards information technologies. Specially, it includes Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), and Theory of Planned Behavior (TPB) at behavioral decision theory domain and Flow Theory and Cognitive Absorption at motivation theory domain.

2.1 Behavioral decision theories

Information systems are at high risk of failing when psychological, social and organizational factors are ignored by designers (Robey, 1979); and are surely to fail if improperly designed. With that in mind, undertaking the development and usage of an information system requires long-term organizational commitment from both the financial and adoption perspectives. This commitment is costly and in most cases has a relatively low success rate (Lewis et al., 2003).

The difficulty in the implementation of IS has been studied for over three decades. IS research has attempted to better understand the system development process and the factors that make its implementation successful. As a result, the majority of the studies in IS field focused on investigating usability (Adams et al., 1992; Davis, 1989; Davis, 1993; Davis et al., 1989; Davis et al., 1992; Hartwick & Barki, 1994; Mathieson, 1991; Thompson et al., 1991). Despite the enormous expenditure of time, capital, and effort that have been invested on IT, the benefits and advantages of IT on productivity growth and business performance cannot be achieved without users' involvement and participation (Lewis et al., 2003). In general, user acceptance and usage are important primary measures of success for any information systems (DeLone & McLean, 1992). It is therefore not surprising that a long list of theoretical models and variables that proved to help in predicting system use has been discussed by IS researchers (Legris et al., 2003). Indeed, IT acceptance and usage research has been considered as one of the most mature research areas in contemporary IS literature (Hu et al., 1999).

Competing theoretical models, each with different roots suggesting a set of behavior determinants has been proposed to explain the variance in individual intention to use technology (Venkatesh et al., 2003). The researchers intensively discussed and empirically compared eight prominent models in user IT acceptance literature. The eight models reviewed are the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model (MM), the Theory of Planned Behavior (TPB), a model combining the technology acceptance model and the theory of planned behavior, the model of PC utilization (PCU), the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT). The models represent two different perspectives to predict the behavior of technology acceptance (Saleem, 2005). The IDT, for example, emphasizes on the characteristics inherent to a specific technology and their influence on acceptance; while as several models are in the category of the belief-attitude-behavior models (e.g., TAM, TRA and TPB), which base their analyses on how users' beliefs and behavioral intention are influenced by various external factors such as technology characteristics (Benbasat & Dexter, 1986; Davis, 1993; Dickson et al., 1986), cognitive style (Huber, 1983), individual differences (Agarwal & Prasad, 1999; Saleem et al., 2005; Taylor & Todd, 1995).

2.1.1 Theory of Reasoned Action (TRA)

The TRA (Figure 2.1), which derives from the social psychology field, is one of the most fundamental theories of human behavior across a wide variety of domains. It is formulated to "explain virtually any human behavior" (Ajzen & Fishbein, 1980, p. 4) and therefore the use of the theory on IS usage behavior study could be considered as an application on a specific case (Davis et al., 1989). Two of its core constructs are attitude towards a specific behavior and subjective norm. Attitude has been defined in the TRA as the individual's affect towards performing a target behavior. Subjective norm has been defined as the individual's perception of what the people important to him/her think he/she should do with respected to the behavior in question (Fishbein & Ajzen, 1975). Sequentially, these two internal psychological variables will determinate the strength of one's intention to perform a specified behavior, behavioral intention. The conception of internal variables is used to against external factors that "influence behavior d so only indirectly by influencing attitude, subjective norm, or their relative weights" (Davis et al., 1989, p. 984).

A substantial body of researches empirically supports the formulation of TRA in research settings spanning a variety of subject areas (Davis et al., 1989). For instance, Hsu and Lu (2004) observed social influences as well as attitude have significant positive impact on the user's intention to play online games. More recently, Choi et al (2006) applied TRA to an e-learning system for ERP training and found empirical support of the salience of attitude in learning outcomes in the context of ERP training with the web-based e-learning system.

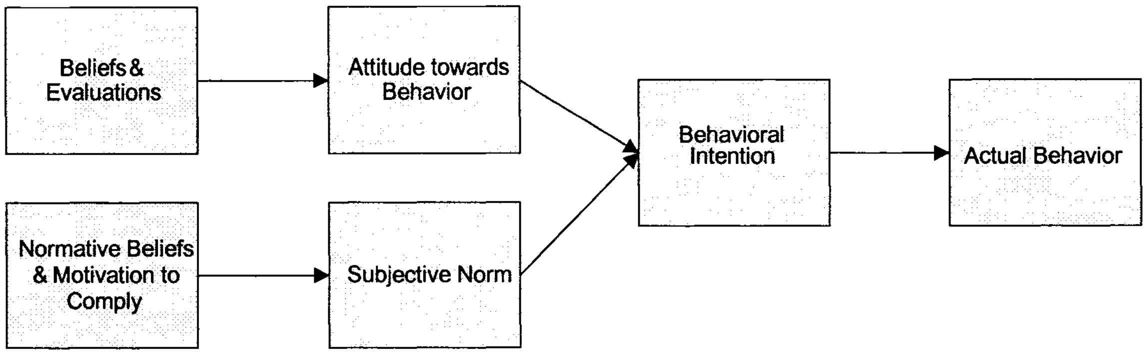


Figure 2.1 Theory of Reasoned Action

2.1.2 Technology Acceptance Model (TAM)

The TAM (Figure 2.2), which is an adaptation of TRA, dominates the IS literature on individuals' IT usage behavior (Legris et al., 2003). In the TAM, Davis (1989) proposes that the influence of other variables on technology acceptance is mediated by two individual beliefs: perceived ease of use (PEOU) and perceived usefulness (PU). In the original formulation of TAM, attitude plays a mediating role on the effects of beliefs on intentions. Although in subsequent studies, many researchers dropped it from the specification of TAM, in a recent research, the significant effect of attitude in multimedia learning environment has been observed with a large sample pool.

Perceived ease of use refers to the degree to which an individual believes that using a particular system would be free of effort, whereas perceived usefulness is defined as the degree to which an individual believes that using a particular system would enhance his or her job performance (Davis, 1989). PEOU has been shown that individuals would have more intention to accept new technologies, if they feel that less cognitive effort they need to perform during the interaction (Saadé et al., 2007). Davis argues that PEOU derives from intrinsic motivation aspect human-computer interactions.

Self-efficacy theory, a cost-benefit paradigm, and adoption of innovations research are three major theoretical pillars to support the effect of PU on behavioral intention. In stark contrast to PEOU, Davis et al (1992) defines PU as an extrinsic motivator of human-computer interactions. According to a comprehensive comparison study of user acceptance models, PU is the primary predictor of "…intention and remains significant at all points of measurement in both voluntary and mandatory settings" (Venkatesh et al., 2003, p. 447). PU is also posited to influence behavioral intentions to use through two causal avenues: a direct relationship and an indirect relationship via attitude. The remaining two relationships support the notion that the level of cognitive burden imposed by a technology would influence the individual's expectancy on instrumental awards (Davis et al., 1989).

Numerous empirical studies have provided considerable supports to the formulation of TAM under different technologies (Chau, 1996). Specifically, several studies about online learning affirm the validity of the influence of perceived ease of use and usefulness on users' acceptance intention. For example, Saadé and Bahli (2005) found that the usefulness has significant impact on behavioral intention as well as ease of use is a predictor of usefulness and intention to use the Internet-based learning system. Similar findings were replicated by Lee et al (2005) in a study of investigating roles of intrinsic and extrinsic motivation on intentions to use an Internet-based learning medium; and by Yi & Hwang (2003) in a study to extend the TAM by incorporating the motivation variables in the context of a web-based class management system. More recently, Saadé et al.(2007) statistically confirmed viability of TAM in a multimedia learning environment. They conducted a comparative study consisting of 362 students, which is almost three times the sample size of the counterpart study, participating to test the original conceptualization of TAM. Despite some minor differences in the parameters of relationships, the findings validate TAM as basis for future research on e-learning technology acceptance behavior.

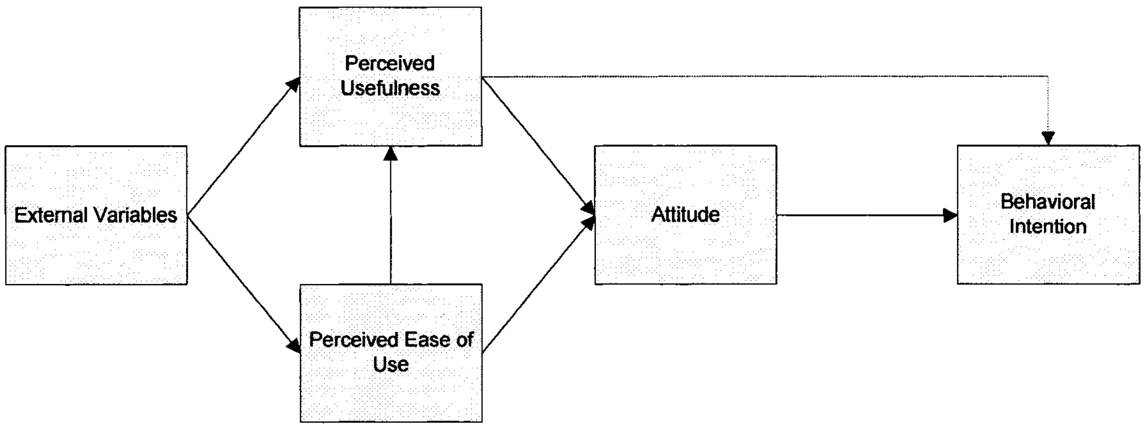


Figure 2.2 Technology Acceptance Model

2.1.3 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), which is considered as a later and expanded version of the TRA, includes all of the former theory's constructs plus those unique to the TPB (Harrison et al., 1997). The TPB (Figure 2.3) posits that behavioral intentions to perform a behavior are jointly determined by three factors: attitude toward the behavior (ATT), subjective norms (SN), and perceived behavioral control (PBC). Both of attitude and subjective norm are defined as in TRA. The additional construct, perceived behavioral control, refers to individuals' perception of the ease or difficulty of performing the behavior of interest (Ajzen, 1991). In a later study, Taylor & Todd (1995) made a minor revision of the definition of PBC for its discussion in the context of the IT domain as "perceptions of internal and external constraints on behavior" (p. 149).

A range of disciplines such as leisure behavior, marketing/consumer behavior and medicine have applied TPB successfully in their researches (Ajzen, 1991). Researchers also found empirical support for predicting the intention on the adoption of new technologies. Harrison et al (1997) surveyed 162 small businesses to investigate how the executives of these firms to decide to adopt IT. Results indicate strong support for a decision process based on the formulation of TPB regarding IT adoption. The findings are replicated by Taylor and Todd (1995) in a study of a comparison of the three intentions models using student data collected from 786 potential users of a computer resource center. They found that all 3 models performed well in terms of fit and were roughly equivalent in terms of their ability to explain behavior. Carswell and Venkatesh (2002) investigate student outcomes in terms of acceptance, learning and future intention outcomes, in an asynchronous distance learning environment. Their findings suggest that the importance of student perceptions of technology in data collected both students' acceptance outcomes as well as future use intention was again supported (Alavi & Leidner, 2001).

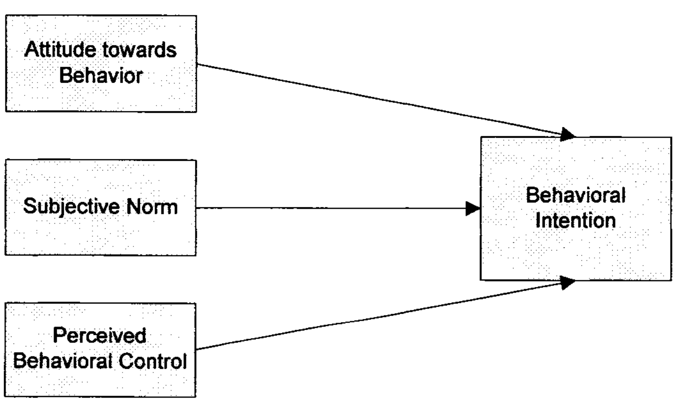


Figure 2.3 Theory of Planned Behavior

2.2 Motivation theories

Motivation theorists argue that motivation formulates the mechanism of human behavior and action. When a person is unmotivated, she/he would feel no impetus or inspiration to act; whereas someone, who is energized or engaged on some activities toward an end, is considered motivated. It is not uncommon to view motivation as a unitary phenomenon in most theories of motivation, one that differentiates each other in levels. However, some researchers suggest that people have not only different amount, but also different orientations of motivation. They distinguish motivation to two broad classes, intrinsic and extrinsic motivation, according to the different reasons or goals to perform an action. Intrinsic motivation refers to the performance of an activity for no apparent reinforcement or instrumentality other than to experience pleasure and satisfaction in the activity. In contrast to intrinsic motivation, extrinsic motivation is typically associated with expectation of instrumental outcomes that are distinct from the activity itself, such as improved job performance, when a person is performing an activity.

In the domain of IT specifically, Davis et al (1992) introduce this theoretical base from individual psychology to explain individual behavior toward new information technologies. In the subsequent research, a number of studies have discussed motivational variables in different contexts, especially about intrinsic motivation. Motivational constructs, which focuses on an individual's subjective feelings of joy, elation, pleasure, and positive holistic experience on IT usage, have been empirically confirmed to be significant predictors of several important outcomes related to technology use. This thesis reviews the articles published from 1990 to 2006 in periodicals known to include this type of study including MIS Quarterly, Decision

Sciences, Management Science, Journal of Management Information System, Information System Research, and Information and System. Based on the references of the articles initially founded, a number of research studies from other academic sources are also selected. In total, there are 30 papers that fit the selection requirements in terms of the empirical study, the application of motivation theory, and the wells described research methodology as well as clean research findings. Table 2.1 summarizes the research settings, motivational variables and their influential significances on outcomes of IT usage. Indeed, Table 2.2 reviewed the items used for measuring these constructs in prior research.

Table 2.1 The summary of empirical studies on motivational variables

Authors	Context	Independent Variable	Dependent Variable	Effect (beta)
Agarwal & Karahanna (2000)	Web	Cognitive absorption	PEOU	.587
			PU	.518
			BI	.246
		Computer Playfulness	Cognitive absorption	.36
		PIIT		.408
Atkinson & Kydd (1997)	Web (Study 1)	Enjoyment	Usage	.15 (Course-related)
				.31 (Entertainment)
	Web (Study 2)			-.17 (Course-related)
				.25 (Entertainment)
Choi et al.(2006)	Web-based learning system	Learner Interface	Flow experience (F) & Attitude (A)	0.346 (F)/ 0.209 (A)
		Interaction		0.269 (F) / n.s
		Instructor attitude towards students		0.107 (F) / n.s
		Instructor technical competence		n.s/ 0.146 (A)
		Content		0.388 (F) / 0.269 (A)
		Flow experience	Attitude	0.238
		Flow experience	Self-efficacy in ERP usage	0.296
		Attitude		0.323
Davis et al (1992)	A word process program	Enjoyment	BI	.16
	Two graphics systems			.15
Davis & Wiedenbeck (2001)	Word processing systems	Flow	PEOU	.5788
Ghani & Deshpande (1994)	Computer	Flow	Exploratory use	.29 Low task-scope (L)
				.35 High task-scope (H)
		Challenge	Flow	.55 L
				.26 H
Hackbarth et al (2003)	Microsoft Excel	Computer playfulness	PEOU	.23
Heijden (2003)	Portal website	Perceived enjoyment	Attitude	.23
Hsu & Lu (2004)	Online game	Flow	BI	.12
			Attitude	n.s
Igbaria et al (1995)	Microcomputer	Perceived enjoyment	Usage	n.s
Igbaria et al (1996)	Microcomputer	Perceived enjoyment	System usage	.08
Koufaris (2002)	Online shopping	Shopping enjoyment	BI	.4
		Challenge	Shopping Enj	.358
			Concentration	.221

Table 2.1 continued				
Lee et al(2005)	Internet-learning portal	Perceived enjoyment	BI	.17
			Attitude	.53
Liu et al (2005)	Text-audio	Flow (concentration)	BI	n.s
	Audio-video			.174
	Text-audio-video			.265
Martocchio & Webster (1992)	Microcomputer training activities	Computer playfulness (Correlation)	Positive mood	.31
Moon & Kim (2001)	Web	Playfulness	BI	.25
			Attitude	.26
Novak et al (2000)	Web	Challenge/Arousal	Flow	.09
Saadé & Bahli (2005)	Internet-based learning system	Cognitive absorption	PEOU	.24
			PU	.36
			BI	.17
Sánchez-Franco & Roldán (2005)	Web	Flow	BI	.234 Experiential
				.192 Goal-directed
			PU	.405 Experiential
				n.s Goal-directed
Shang et al (2005)	On-line shopping	Cognitive absorption	PEOU	.55
			PU	.29
			Behavior	n.s
Sun & Zhang (2004)	Internet search engines (Model 1)	Computer playfulness	BI	n.s
			PEOU	.376
	Model 2	Perceived enjoyment	BI	n.s
			PEOU	.652
		Computer playfulness	BI	n.s
			PEOU	n.s
Teo et al (1999)	Internet	Perceived enjoyment	Diversity of Internet usage	n.s
			Frequency of Internet usage	.09
			Daily Internet usage	.09
Trevino & Webster (1992)	e-mail/voice mail system	Flow	Attitude	.43
			Effectiveness	.44
			Quantity	.25
			Barrier reduction	n.s
Venkatesh (2000)	Online help desk	Perceived playfulness (P) Perceived enjoyment (E)	PEOU	.20 P
				n.s E
	Multi-media system			.16 P
				.19 E
	PC-based environment for payroll application			n.s P
				. 24 E

Table 2.1 continued					
Venkatesh & Speier (2000)	Virtual Workplace System	Perceived enjoyment	BI	.27 Traditional	
				.59 Game-based	
Venkatesh et al (2002)	Virtual Workplace system	Perceived enjoyment	BI	n.s	
			PEOU	.45	
			PU	.27	
Webster & Martocchio (1992)	Computer applications	Playfulness (Correlation)		Study 3	Study 5
			Involvement	.18	.52
			Mood	.31	.35
			Satisfaction	---	.32
			Learning	.25	.44
Webster et al (1993)	E-mail system	Flow/Playfulness (Correlation)	Usage	.82	
Webster & Martocchio (1995)	Training software	Cognitive playfulness	Flow	.36	
		Flow	Learning	.28	
			Satisfaction	.55	
			Post-training reactions	.39	
Yi & Hwang (2003)	Web-based system (Blackboard system)	Enjoyment	PEOU	.41	
			PU	.50	
PEOU = perceive ease of use; PU = perceived usefulness; CSE = computer self-efficacy; BI = behavioral intention; PIIT = personal innovativeness of information technology					

Table 2.2 The summary of motivational instruments

ENJOYMENT	(Ghani, 1995; Ghani & Deshpande, 1994; Ghani et al., 1991)	(Sánchez-Franco & Roldán, 2005)	(Webster et al., 1993)	(Saadé & Bahli, 2005)	(Agarwal & Karahanna, 2000)	(Koufaris, 2002)	(Atkinson & Kydd, 1997; Davis et al., 1992; Heijden, 2003; Igbaria et al., 1996; Lee et al., 2005; Venkatesh, 2000; Venkatesh & Speier, 2000; Venkatesh et al., 2002; Yi & Hwang, 2003)	(Igbaria et al., 1995; Teo et al., 1999)	(Skadberg & Kimmel, 2004)	(Anandarajana et al., 2002)
1. Interesting ------------- Uninteresting	X					X				
2. Fun ---------------- Not fun	X	X	X	X	X	X	X	X		X
3. Exciting------------- Dull	X					X		X		
4. Enjoyable -------------- Not enjoyable	X	X	X	X	XX	X	X	X	X	
5. Browsing web is pleasant		X					X	X		
6. Browsing web is entertaining		X								
7. Using WWW keeps me happy for my task			X							
8. Negative – Positive								X		
9. Pleasurable – Painful								X		X
10. Foolish – Wise								X		
11. Rewarding – punishing										X
12. Beneficial – harmful										X
13. Using the ILS bores me				X	X					

Concentration	(Ghani, 1995; Ghani & Deshpande, 1994; Ghani et al., 1991; Koufaris, 2002; Liu et al., 2005)	(Sánchez-Franco & Roldán, 2005)	(Webster et al., 1993)
1. I am deeply engrossed in activity	X		
2. I am absorbed intensely in activity	X	X	
3. Attention is focused on activity	X	X	
4. Concentrate fully on activity	X	X	
5. When interacting with WWW, I do not realize the time elapsed			X
6. When interacting with WWW, I am not aware of any noise			X
7. When interacting with WWW, I often forget the work I must do			X

Table 2.2 continued

Curiosity	(Webster et al., 1993)	(Agarwal & Karahanna, 2000; Huang, 2003)
1. Using WWW stimulates my curiosity	X	X X
2. Using WWW leads to my exploration	X	
3. Using WWW arouses my imagination	X	X

Temporal Dissociation	(Agarwal & Karahanna, 2000)	(Saadé & Bahli, 2005)	(Skadberg & Kimmel, 2004)
1. Time appears to go by very quickly when I am using the Web	X		X
2. Sometimes I lose track of time when I am using the Web	X	X	
3. Time flies when I am using the Web	X	X	
4. Most times when I get on to the Web, I end up spending more time that I had planned	X	X	
5. I often spend more time on the Web than I had intended	X	X	

Focused Immersion	(Agarwal & Karahanna, 2000)	(Saadé & Bahli, 2005)
1. While using the Web I am able to block out most other distractions	X	X
2. While using the Web, I am absorbed in what I am doing	X	X
3. While on the Web, I am immersed in the task I am performing	X	X
4. When on the Web, I get distracted by other attentions very easily	X	
5. When on the Web, my attention dose not get diverted very easily	X	

Table 2.2 continued

Control	(Agarwal & Karahanna, 2000; Huang, 2003)	(Koufaris, 2002)	(Taylor & Todd, 1995)
1. When using the Web I feel in control	X	X	X
2. I feel that I have no control over my interaction with the Web	X		
3. The Web allows me to control my computer interaction	X		
4. I felt confused		X	
5. I felt calm		X	
6. I felt frustrated		X	
7. I have the resources and the knowledge and the ability to make use of the Computing Resource Center			XX

Playfulness	(Moon & Kim, 2001)	(Liu & Arnett, 2000)	(Webster & Martocchio, 1992)
1. When interacting with WWW, I do not realize the time elapsed	X		
2. When interacting with WWW, I am not aware of any noise	X		
3. When interacting with WWW, I often forget the work I must go	X		
4. Using WWW gives enjoyment to me for my task	X	X	
5. Using WWW gives fun to me for my task	X		
6. Using WWW keeps me happy for my task	X		
7. Using WWW stimulates my curiosity	X		
8. Using WWW leads to my exploration	X		
9. Using WWW arouses my imagination	X		X
10. Motivate customers to feel participation		X	
11. Promote customer excitement		X	
12. Charming feature to attract customers		X	
13. Promote customer concentration		X	
14. when using the web I am spontaneous			X
15. when using the web I am flexible			X
16. when using the web I am creative			X
17. when using the web I am playful			X
18. when using the web I am original			X
19. when using the web I am inventive			X

Table 2.2 continued	
Fun Perceptions	(Perry & Ballou, 1997)
1. To what extent was the Excel training fun	X
2. How enjoyable was the Excel training	X
Attention Focus	(Huang, 2003)
1. When navigating this website, I thought about other things.	X
2. When navigating this website, I was aware of distractions.	X
3. When navigating this website, I was totally absorbed in what I was doing.	X
Intrinsic Interest	(Huang, 2003)
1. Navigating this website bored me.	X
2. Navigating this website was intrinsically interesting.	X
3. This website was fun for me to use.	X

The synopsis of previous work in psychology, human-computer interaction as well as online marketing research supports that intrinsic motivators describing holistic experiences with technology are important explanatory variables in theories about behaviors. In this notion, two motivation constructs have been applied in a wide range of technologies context in recent years. One is the state of flow described by Csikszentmihalyi (1990) capturing an individual's subjective enjoyment of the interaction with the technology, and the other is cognitive absorption, representing five basic aspects of individual experience on the interaction.

2.2.1 Flow theory

Flow, "the state in which people are so involved in an activity that nothing else sees to matter", was proposed by Csikszentmihalyi (1990, p. 4), who has extensively studied this topic during the past 20 years. People experience flow when they are deeply involved in some event, object or activity for its own sake that they excel in the performance without awareness on time and continually partake in the consumption event (Finneran & Zhang, 2005; Mannell et al., 1988). It is a multi-dimensional construct including four basic ingredients in terms of intense concentration, a sense of being in control, a loss of self-concentration, and a transformation of time. Previous researchers have extended the study on this state of optimal experience from its original applications on sports to a broad range of contexts including work, shopping, games, dancing, hobbies and computer use and others (Csikszentmihalyi & LeFevre, 1989; Novak et al., 2000).

In recent years, flow theory has been used in the discipline of IT to address optimal user experience with human-computer interaction (Davis & Wiedenbeck, 2001; Ghani & Deshpande, 1994; Liu et al., 2005; Pilke, 2004; Trevino & Webster, 1992;

Webster et al., 1993), individual online behavior (Agarwal & Karahanna, 2000; Chen et al., 1999; Hoffman & Novak, 1996; Koufaris, 2002; Novak et al., 2003; Novak et al., 2000; Pace, 2004; Sánchez-Franco & Roldán, 2005; Shang et al., 2005), IT-mediated learning (Choi et al., 2006; Saadé & Bahli, 2005; Webster & Martocchio, 1995). Within these contexts, the state of flow has been shown to lead to perceived communication quantity and effectiveness, actual computer usage, positive affect, exploratory behavior, satisfaction, acceptance of information technologies and increased learning outcomes (Choi et al., 2006; Finneran & Zhang, 2005; Woszczynski et al., 2002).

Contrast to the research standing on notions of instrumentality such as perceived usefulness in TAM, flow theory posits that individual attitude and behavior towards the target information technology is shaped by "holistic experiences" with the technology (Agarwal & Karahanna, 2000). Prior studies have collectively affirmed the key role of the flow experience. Trevino and Webster (1992) conduct a study on investigating the effects of flow experience and other variables on user evaluation and perceived impacts of email and voice mail systems. They argue that flow would characterize perceptions and attitudes of individuals towards technologies. Using data gathered from a large health care firm, they found support for the argument.

Building upon the conception of flow, Hoffman and Novak (1996) develop a theoretical model of flow within the hypermedia computer-mediated environment of the web. They theoretically argue that the flow would lead to several outcomes such as increased learning, perceived control, exploratory mindset and positive experience. In subsequent work Novak et al (2000) make some substantial changes in the previous model and test it empirically using structured equation modeling to develop a revised theoretical model. Findings suggest that "the revised model provides additional insights into the direct and indirect impacts of flow, as well as into the relationship of flow to key consumer behavior and web usage variables" (Novak et al., 2000, p. 22). They, therefore, recommend that marketers could use this model to explain consumer behavior variables, including online shopping and web use applications.

Although much research has been conducted to improve the body of knowledge on the characteristics and the effects of flow on individual outcomes in human-computer interaction, various measures of this construct in previous studies hardly generate conclusive results to support cumulative research. For example, researchers have identified as many as 16 different variables that form possible factors for the more general composite construct of flow. However, the number of use and the classification of the constructs vary from one to another study. In present study, we synthesized and categorized the principal factors used in literature to reflect the state of flow itself (Table 2.3).

Table 2.3 The summary of flow instruments

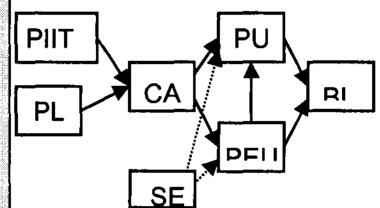
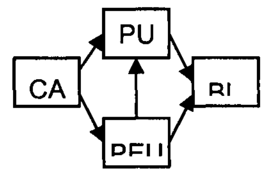
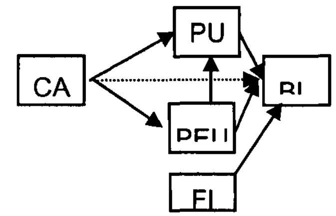
FLOW EXPERIENCE	(Hsu & Lu, 2004; Novak et al., 2000)	(Trevino & Webster, 1992)	(Shang et al., 2005)	(Davis & Wiedenbeck, 2001)	(Pearce et al.)
1. Do you think you have ever experienced flow in playing on-line game	X				
2. In general, how frequently would you say you have experienced "flow" when you play an on-line game?	X				
3. Most of the time I play an on-line game I feel that I am in flow.	X				
4. When using the electronic (phone) mail system, I feel in control		X	X X	X	X
5. When using the electronic (phone) mail system, my attention is focused totally on using the system		X			
6. Using electronic (phone) mail excites my curiosity		X	X X		X
7. Using electronic (phone) mail is intrinsically interesting		X			X
8. I have fun interacting with the Web			X		
9. Using the Web provides me with a lot of enjoyment			X X X		X
10. Using the Web arouses my imagination			X		
11. I thought about other things				X	X
12. I had to make an effort to keep my mind on the activity				X	
13. I was aware of distractions				X	X
14. I was aware of other problems				X	
15. Time seemed to pass more quickly				X	
16. I knew the right things to do				X	
17. I felt like I received a lot of direct feedback				X	
18. I felt in harmony with the environment				X	
19. I was absorbed intensely by the activity					X
20. I was frustrated by what I was doing					X
21. The activities bored me					X
22. I knew the right thing to do					X
23. It required a lot of effort for me to concentrate on the activities					X

2.2.2 Cognitive absorption

Extending the conceptualizations of flow as discussed in previous studies, Agarwal et al. (1997) propose a new construct called cognitive absorption (CA) to study individuals' technology use behavior. Cognitive absorption, which derives its theoretical foundations from work in the trait of absorption, the state of flow and the notion of cognitive engagement, posits its understanding of technology use behavior from users' holistic experiences with the technology. Agarwal and Karahanna (2000) defines cognitive absorption (CA) as "a state of deep involvement with software." Essentially, CA represents a form of intrinsic motivation, where a behavior is performed because it is inherently interesting or enjoyable rather than extrinsic rewards from the behavior (Ryan & Deci, 2000; Vallerand, 1997). CA suggests that when users experience a state of deep involvement with technology where they lose the track of time (temporal dissociation), ignore other attentional demands (focused immersion), capture the pleasurable aspect of the interaction (heightened enjoyment), perceive the ease of managing the interaction (control), and their sensory and cognitive curiosity are aroused (curiosity), there are many positive outcomes from this type of involvement such as positive attitude (Trevino & Webster, 1992), high behavioral intention on technology use, and exploratory technology use (Ghani & Deshpande, 1994).

In subsequent work, IS researchers have discussed how significantly CA determinates users' perceptions of technologies, especially in the online context. Saadé and Bahli (2005) extend the TAM with CA in order to explain the acceptance behavior of students on Internet-based learning systems. They argue that temporal dissociation, focused immersion and heightened enjoyment are three facets of CA under this context, and find out that when an individual experiences a state of CA, the individual's beliefs about the system will be significantly influenced. Shang et al (2005) apply this conception on shopping online and observe that CA will increase people's intention to perform online shopping via PEOU (see Table 2.4 and Table 2.5). Its ability to explain behavioral outcomes toward information systems is salient at individual level during implementation phases (Lapointe & Rivard, 2007).

Table 2.4 The cognitive absorption research models

	Agarwal & Karahanna (2000)	Saadé & Bahli (2005)	Shang et al.(2005)
Model			
Research Question	Can we get better understanding of individual technology usage intention, if incorporating holistic experiences with technology	Why do students intend to accept Internet-based learning systems in their study	If intrinsic motivations can be used to explain consumers' acceptance of online shopping
Target technology	Web	Internet-based learning system	Online shopping webs
Respondents	288 university students	102 business students	205 students and 318 web users
Findings	CA relates to both PU and PEU; both PU and PEU are significantly related to BI; CA is also strongly and directly related to BI but linkage between PEU and BI is weak.	CA significantly relates to PU but less important to PEU; PU has strong relationship with BI but not PEU; CA seemed to explain the intention directly and indirectly	CA is significantly related to PEU but less import to PU. PEU strong relates BI but PU is not. CA has no impact on BI directly

PIIT = Personal Innovativeness, PL = Playfulness, CA= Cognitive Absorption, SE= Self-Efficacy, PU = Perceived Usefulness, PEU = Perceived Ease of Use, BI = Behavioral Intention, FI = Fashion Involvement

Table 2.5 Summary of prior studies incorporating cognitive absorption

Authors	R^2 of BI with CA	R^2 of BI without CA	CA → BI	CA → PU	CA → PEU	PEU → PU	PU → BI	PEU → BI
Agarwal & Karahanna (2000)		48%		0.517***	0.578***	0.196	0.475***	0.307***
	50.7%		0.25***	0.518***	0.587***	0.196***	0.367**	0.208*
Saadé & Bahli (2005)		26%		0.36***	0.24*	0.28**	0.43***	0.16*
	28.9%		0.17*	**PU → CA**	**PEU → CA**			
				0.38***	0.094			
Shang et al.(2005)	n/a		-0.0	0.29**	0.55**	0.53**	-0.05	0.25*

PU= Perceived Usefulness, PEU=Perceived Ease of Use, BI=Behavioral Intention, CA = Cognitive Absorption

* significant at p<0.05; ** significant at p<0.01; *** significant at p<0.001

3 DEVELOPMENT OF RESEARCH MODEL AND HYPOTHESES

This current section introduces the research model that has been developed based on the literature review in the previous section. Furthermore, the hypothesized relationships among research constructs are detailed sequentially.

In order to investigate from an integrated view to understand individuals' behavior under the multimedia learning environment, this study proposes a theoretical research model grounded in the empirical IS literature and motivation theories.

3.1 Research Model

The Figure 3.1 presents the research model. All constructs of three intention-based models are included to test their influences on one's behavioral intention; and the impact of CA on the intention is mediated by individual beliefs. Although CA has been shown to influence behavioral intention directly (Agarwal & Karahanna, 2000; Saadé & Bahli, 2005), the formulation of intention models suggests that the effect of all external variables is mediated by cognitive beliefs (Davis et al., 1989). Therefore, consistent with theoretical bases of intention models, we posit that the effects of CA on behavioral intention are mediated by beliefs in this model.

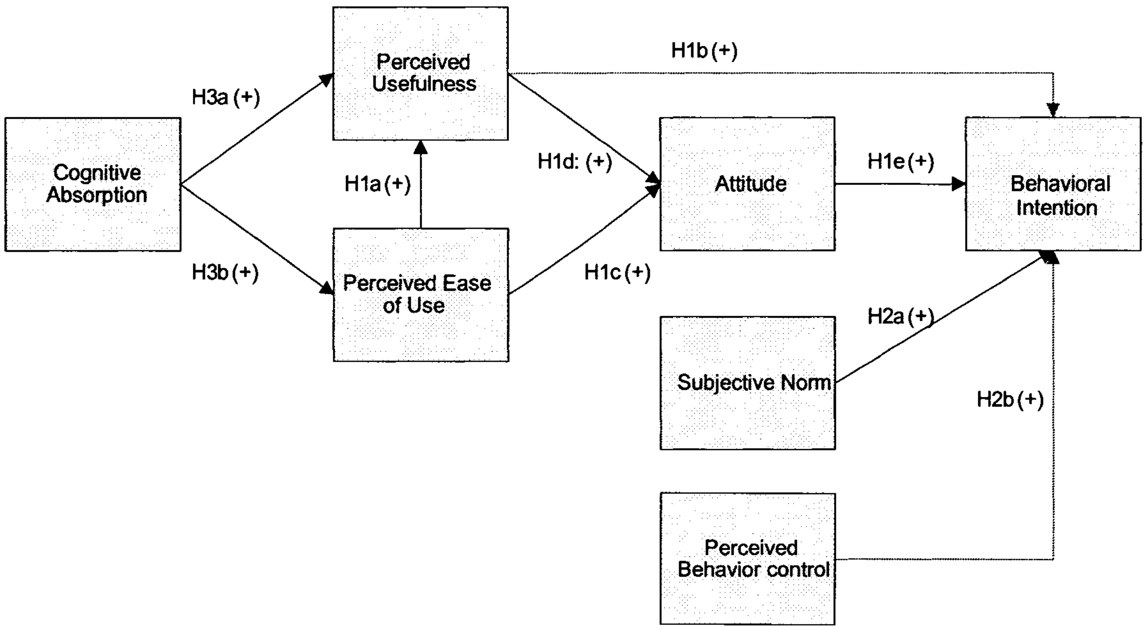


Figure 3.1 The Research Model

3.2 Research Hypotheses

The research hypotheses as shown in Figure 3.1 are presented below and grouped by theoretical bases.

3.2.1 TAM

In present study, we advocate the original formation of TAM that argues the individual acceptance intention towards information technologies is jointly determined by perceived usefulness and attitude according its appropriateness for the context of multimedia learning, a state-of-art TML system (Saadé et al., 2007). In addition, attitude mediates effects of usefulness and ease of use on behavioral intention. PU was defined as the extent to which a student believed that using the TML system would enhance his/her performance in the course, while PEU was defined as the extent at which the student believed that using the TML system was free from cognitive effort. PEU inherits the notion of self-efficacy by capturing one's beliefs about one's ability to successfully carry out a particular behavior; while as the free of cognitive burden enhances the individual to expect the instrumental awards, PU, from carrying out the behavior. We also include this relationship in this study, since we hypothesize that student who perceived the system easier to use would also perceived it be more useful with support from previous studies (Chau, 1996)

In consistence with theoretical bases of TAM, we test the following hypothesis in the context of the TML system:

H1a: ***Perceived ease of use will have positive influence on the perceived usefulness of the TML system***

H1b: ***Perceived usefulness will have positive influence on behavioral intention of the TML system usage***

H1c: ***Perceived ease of use will have positive influence on attitude towards TML system***

H1d: ***Perceived usefulness will have positive influence on behavioral intention of the TML system usage***

H1e: ***Attitude towards TML system will have positive influence on behavioral intention***

3.2.2 TPB and TRA

In this study, we empirically examine the capability of the TRA and the TPB to predict and explain how students decide to adopt a TML system to perform their study. As the TPB is a later and expanded version of the TRA that also incorporates TRA's constructs, we jointly discuss the hypotheses of the constructs.

Subjective norm is the person's perception that most people who are important to him think he should or should not perform the behavior in question (Fishbein & Ajzen, 1975). In this study, it is defined as "the degree to which the student perceives that others approve of their participating in a technology-mediated learning system". Although researchers have labeled this concept various names (Hsu & Lu, 2004; Karahanna & Straub, 1999; Vijayasarathy, 2004), in most prior studies, subjective norm has direct and significant effect on the individual's acceptance behavior (Schepers & Wetzels, 2006). From social psychological perspective, the influence subjective norm takes place via three distinct processes in terms of internalization, identification and compliance. When an individual perceives that important referents think he should play online games, this person incorporates this belief into his own belief system and change his attitude, since this action could enhance his knowledge, strengthen relationship, and avoid to risks

(Deutsch & Gerard, 1995; Kelman, 1961). With empirical supports from previous studies (i.e. Hsu & Lu, 2004), we hypothesize:

H2a: ***Subjective norm will have positive influence on behavioral intention of the TML system usage***

Perceived behavioral control reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions and technology facilitating conditions (Ajzen, 1991; Taylor & Todd, 1995). Studies using TPB have suggested that perceived behavioral control has impact individuals' behavioral intention in both voluntary and mandatory settings (Venkatesh et al., 2003). Consistent with TPB, we hypothesize:

H2b: ***Perceived behavioral control will have positive influence on behavioral intention of the TML system usage***

3.2.3 CA

In this study, we will use cognitive absorption to characterize the "holistic experience", when the individual partake in activities under the multimedia learning environment. We conceptualize CA as a state of deep involvement with the multimedia learning environment.

Although there is limited prior work examining impact of CA on IT acceptance, it is reasonable to use empirical findings of the state of flow to support the positive relationship between CA, PEOU and PU (Hsu & Lu, 2004), since the core formulation of CA captures the main essence of flow (Agarwal & Karahanna, 2000). According to the theory of flow (Csikszentmihalyi, 1990), when people cognitively engage an activity with enjoyment, the perceived cognitive burden associated with the task will decrease. The lower subjective assessment of the cognitive burden leads to higher level of perceived ease of use (Deci, 1975). We hypothesize:

H3a: ***Cognitive absorption has a significant positive influence on perceived ease of use.***

The relationship between CA and PU derives its theoretical foundation from self-perception theory (Berm, 1972). According to the theory, people are trend to justify and rationalize their behaviors and reduce cognitive dissonance. Cognitive dissonance arises as an individual holds two inconsistent cognitive structures at the same time. Therefore, when users enjoy the pleasure of the interaction with an information system, there is likely to be a natural propensity to account for the efforts spent on the activity by attributing instrumental value more than the recreational aspects of the activity. We test the hypothesis:

H3b: ***Cognitive absorption has a significant positive influence on perceived usefulness***

4 RESEARCH METHODOLOGY

The present section discusses the research setting used to test the research hypotheses proposed in the previous section. The constructs operationalization and measures are presented. Additionally, the tool and procedure used to collect research data are outlined.

4.1 Research setting

The current study employed a cross-sectional web-based survey to investigate the student behavioral intention of using a technology-mediated learning (TML) system to support their study. Specifically, it focuses on a multimedia learning component in the system. The course, which is accompanied by the TML system, is a core course for students major or minor in Management Information System. Instructors lectured students once a week in the traditional classroom. It tries to familiarize the students with an appreciation for the technical conceptions, expose the students to various issues surrounding the management of IS/IT and provide them with practical knowledge of some basic MIS tools.

4.2 The target learning environment

The target TML system was developed using HTML and scripting languages with active server pages (ASP) support to communicate with the database. The HTML and ASP files are very simple in design and do not include any distracting objects. The design of the system integrated the instructional design of the course with some pedagogical elements in mind. It includes eight components in terms of Midterm, Final exam, Quizzes, Web project submission, Forum, Questions Center, Media Center and Multimedia learning environment. Student can access the system through Internet anytime and anywhere.

Students take their tests and assignments using knowledge assessment module (Midterm, Final exam, Quizzes, Web project submission) and get supplemental materials such as video clips and power point slides about the course from Media Center and Questions Center.

Moreover, it is an open system, allowing registered students to interact through a knowledge sharing component (Forum). After class, students and instructors can release discussion topics and participate with comments, questions and responses in asynchronous fashion, in the class electronic discussion. The forum is publicly available to all participants in the system and discussion can be threaded, thus allowing students to easily access and read interactions on different subjects. The forum also categorizes threads into different topics in order to enable student to selectively access topics of interests to them while skipping the others.

The multimedia learning environment was developed by using Adobe Flash. It is also called the workplace of Multimedia Entity Relationship Diagram (MMERD), since its entire content is especially about ERD. The MMERD presents instructional materials through the step-by-step method from basic definitions to problem tests (See Appendix C). At each step, key words of displaying learning materials are emphasized visually by using a different color scheme. Each step is also accessible directly through the menu bar, thus allowing students to instantaneously retrieve information as they are confronted with assignments and problems.

Student can rehearse their knowledge on another Flash-based webpage. The interface is made up of four regions/panels. The top panel presents a statement of the problem. The bottom panel includes an icon-based menu that entails the features of this multimedia workspace. The right panel contains the ERD symbols required to solve the problem and the large region in the center is the working area. The symbols given are in the exact amount and style required to complete the given problem. The symbols provided are entities, relationships and cardinalities (many and one). The student must place the correct ERD symbol in the correct relationship order. In this fashion the practice is similar to a puzzle game online, where the ERD symbols are the pieces. The entity specifications used in each problem are supplied by a case given to the user at the beginning of each session. There is only one fully correct answer to each case but there are multiple ways of solving each case depending on the case.

In the practicing problem area of the test, the student is presented with a case that describes the business situation and the database needs. The student then drags one symbol at a time from the object repository panel and drops it in the workspace. This panel is blank at the beginning of the problem. Movement of symbols is permitted at all times within the workspace. If the student places the wrong entity symbol with the wrong relationship symbol the symbol being used is returned to the object repository and 10 points are removed from the total of 100. When a score reaches 70, the student is then given the option to view a hint. If the students score drops to 50 or below, then the student gets the option to have the system present a step-by-step animated presentation of how to solve the problem. At any point during the session the student can view a help sheet, return to the main page or to scroll through other questions. Upon completion of the correct ERD the student is congratulated and given an option to continue with another ERD problem or to return to the main page.

4.3 Constructs operationalization and measures

4.3.1 Constructs of Technology Acceptance Model

Perceived ease of use and usefulness were assessed using a 4-item instruments respectively, on a 5-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5) developed by Davis et al (1989). Based on Ajzen & Fishbein (1980), behavioral intention was measured using 2-items on 5-point Likert scales ranging from Strongly Disagree (1) to Strongly Agree (5).

4.3.2 Constructs of Theory of Reasoned Action and Theory of Planned Behavior

Since TPB incorporates TRA's constructs, we don't discuss their measurements separately. Scales to measure attitude, subjective norm and perceived behavioral control were adapted to the context of MMERD from previous research (Ajzen, 1991; Davis et al., 1989; Taylor & Todd, 1995) on a 5-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5).

4.3.3 Cognitive absorption

Cognitive absorption is measured using the original scale adapted from (Agarwal & Karahanna, 2000). All items are phrased on a five-point Likert-type scale with anchors from Strongly Disagree (1) to Strongly Agree (5).

4.3.4 Demographics

All respondents were questioned on several demographic including major, genders, age, experience of Internet and computer-based activities, and work experiences, if they have. A summary of the measures utilized in the current study is presented in Table 4.1

Table 4.1 Summary of measures

Construct	No. of Items	Scale	Source
PEOU	4	1-5	Davis et al (1989)
PU	4	1-5	Davis et al (1989)
ATT	3	1-5	Ajzen & Fishbein (1980)
BI	2	1-5	Ajzen & Fishbein (1980)
SN	2	1-5	Ajzen & Fishbein (1980); Taylor & Todd (1995)
PBC	3	1-5	Ajzen (1991); Taylor & Todd (1995)
CA	20	1-5	Agarwal & Karahanna (2000)
PEOU = Perceived Ease of Use, PU = Perceived Usefulness, ATT= Attitude, BI = Behavioral Intention, SN= Subjective Norm, PBC = Perceived Behavioral Control, CA= Cognitive Absorption			

4.4 Web-survey design

Since all students who registered this course need to use World Wide Web to perform activities in the system and also provided an email address to the register office for contact, it was decided to use web-based survey for the collection of data. The survey was created by the author using PHP and MySQL technologies (see Appendix B). The entire develop process took approximately 4 weeks to complete, taking into consideration of color schemes, interface, the correct wording of each question, and the procedure of the questions presentation.

4.5 Data collection procedure

The sample of this study consisted of undergraduates from Concordia University's different departments, who registered the course. Students had no prior knowledge of the experimental character of the selected course and signed up based on personal reasons and schedule fit. Students were assigned to different instructors randomly by the register system. At the beginning of the term, students were informed that they need to use the learning environment to accompany with their traditional classroom study. In total, there are 306 potential participants to take this study.

Each student of this course was informed of this study through a system announcement providing a web-link for the survey. The first page of the survey is a cover letter, presented in Appendix A, which explained the purpose of the study, assured respondents of anonymity, and underlined that participation in the study was completely voluntary. In order to increase the participation, instructors sent a group email to registered students to remind this study at the end of the term. In addition, links to the multimedia learning component and a 5% quiz for final preparation were provided on the survey index webpage, where links to all sections of the survey are presented. Students can take the quiz and use the component only, but they also can fill out the survey, if they want.

The system recorded every entrance of each student and the time he/she spent on each entrance in the multimedia learning component. JavaScript and Ajax technology had been adopted to monitor students "real" use of the tool. After the student logged on, the system automatically assigned an access ID to this student, recorded her/his student ID, and triggered a timer to count the duration of the use. For each five minutes, the system popped up a message box to confirm the attention of the user. If the student did not click this reminder, the system stopped the usage timer and closed the whole window immediately.

This experiment lasted one month in order to enable students have enough time to adjust to the environment and experience the features of it thoroughly. In pervious studies, researchers pointed out that the limited duration of the treatment may partially take the responsibility of the lack of convergent findings (Reeves, 1993). Consequently, considerable length of usage and treatment would decrease the risk and provide concrete support for outcomes.

5 DATA ANALYSIS AND RESULTS

The current section describes and graphically presents the characteristics and relevant information of the research sample. The data analysis procedure employing structural equation modeling and results are discussed. Moreover, several supplementary analyses are conducted to explore potential relationships among research constructs.

5.1 Sample characteristics

Approximately 306 individuals were informed to participate in the study. A total of 105 students responded to the survey completely. The response rate is 34%. All respondents are from the departments of the John Molson School of Business. Specifically, 34 students responded from the 83 individuals from Accountancy department; 13 students responded from the 44 individuals from Marketing department; 4 students responded from the 18 individuals from Management department; 1 students responded from the 2 individuals from MIS department; 7 students responded from the 17 individuals from International Business department; 3 students responded from the 9 individuals from Human Resources Management department; 17 students responded from the 43 individuals from General Administration department; 26 students responded from the 84 individuals from Finance department. Students from Economics (5) and Political Science (1) didn't participate to fill out this survey. Broken down by department, Figure 5.1 displays the distribution.

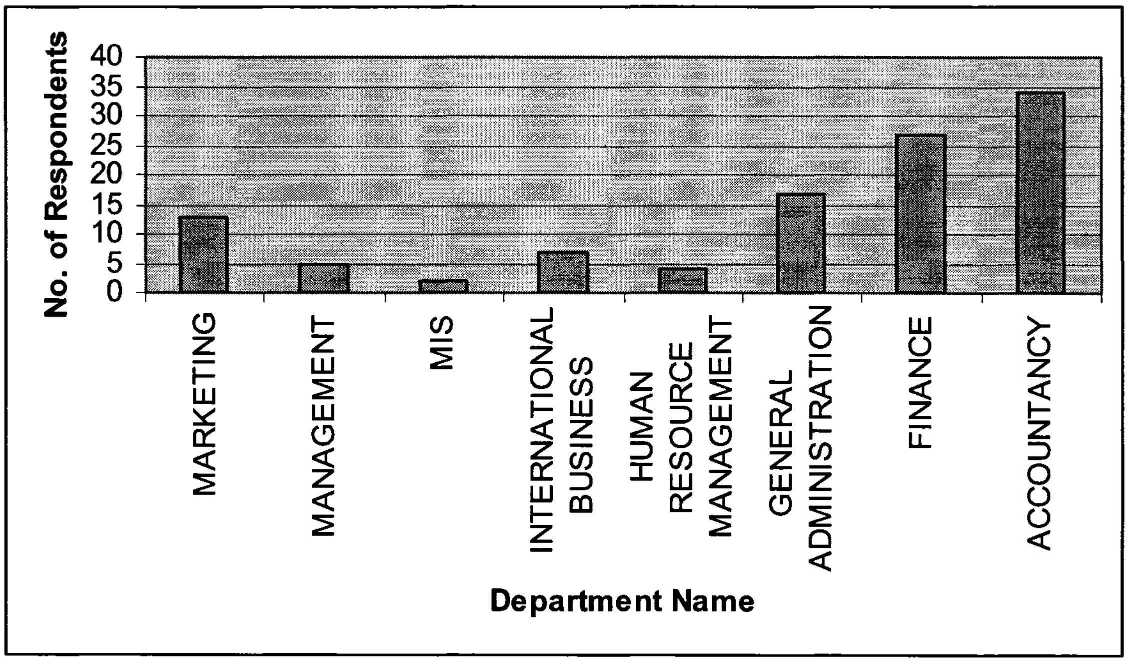


Figure 5.1 Sample of Respondents by Department

As shown in Figure 5.2, a total of 51 respondents were female and 54 were male.

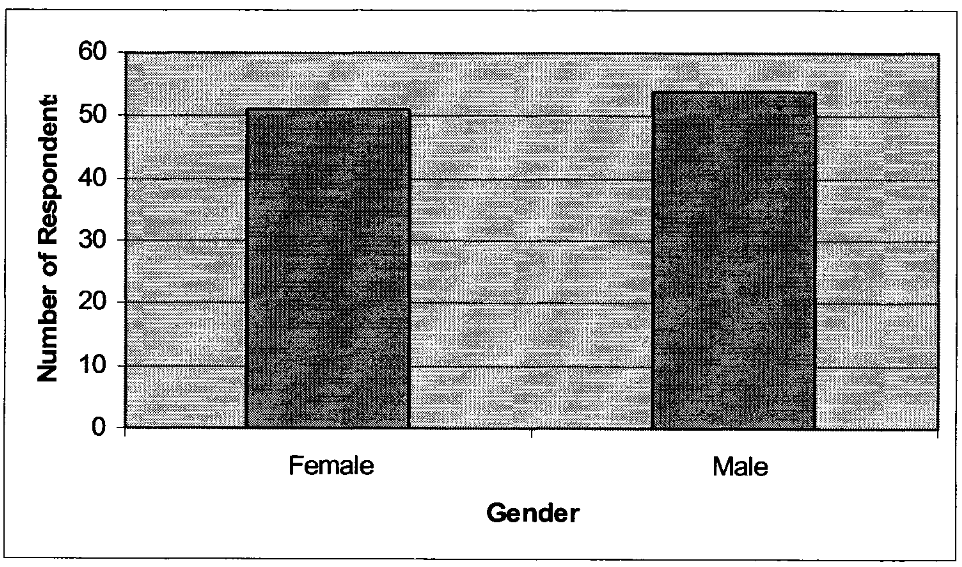


Figure 5.2 Sample of Respondents by Gender

As show in Figure 5.3, respondents reported their previous experience about online course as follow: 34 students have never taken any online courses before, 39 of them have taken one, and 31 students have taken two or more online courses.

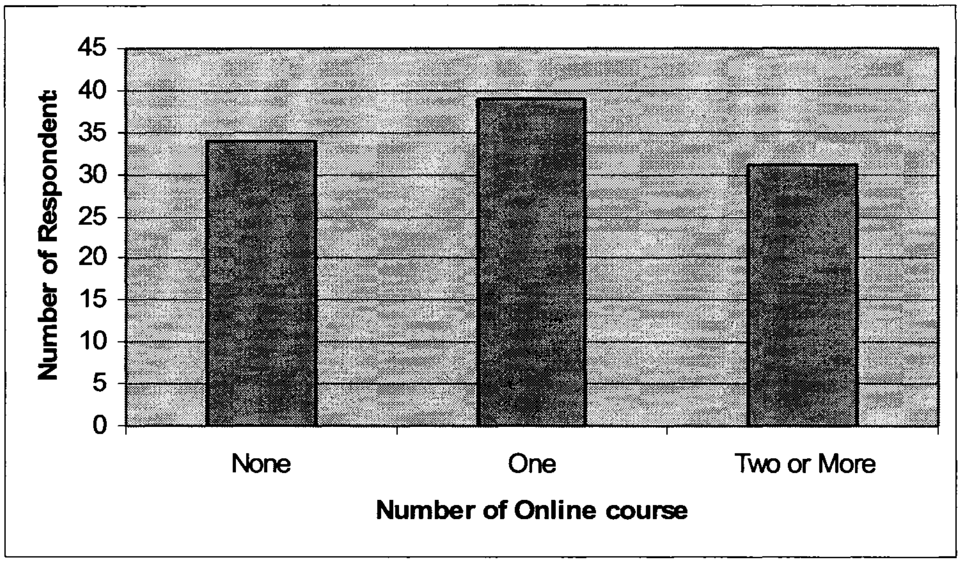


Figure 5.3 Sample of Respondents by online course experience

As show in Figure 5.4, respondents reported their previous experience about using any multimedia for learning as follow: 89 students have never used any multimedia technologies for learning before, 16 of them have experience.

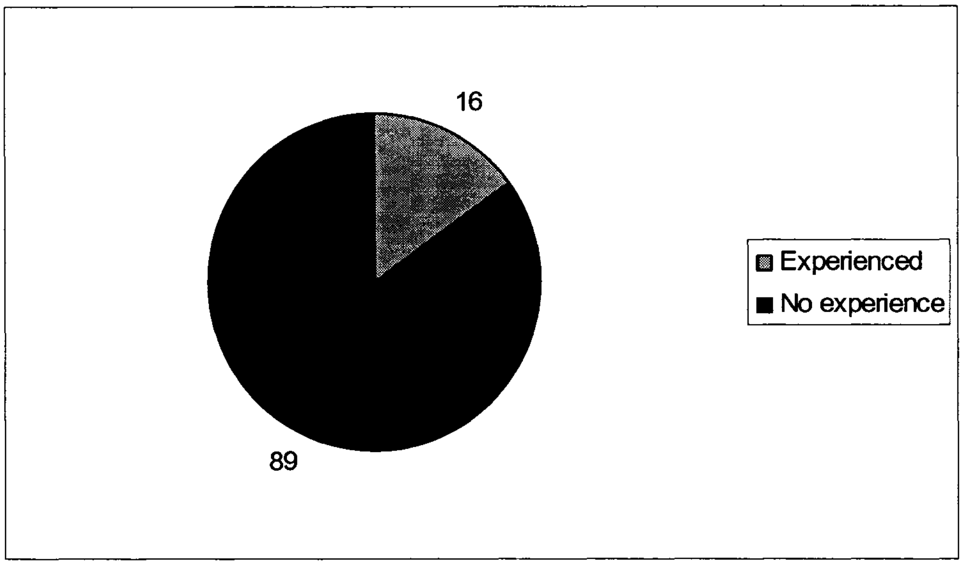


Figure 5.4 Sample of Respondents by multimedia for learning

As show in Figure 5.5, respondents reported their previous experience about play any online games as follow: 62 students have never played online games before, 43 of them have experience.

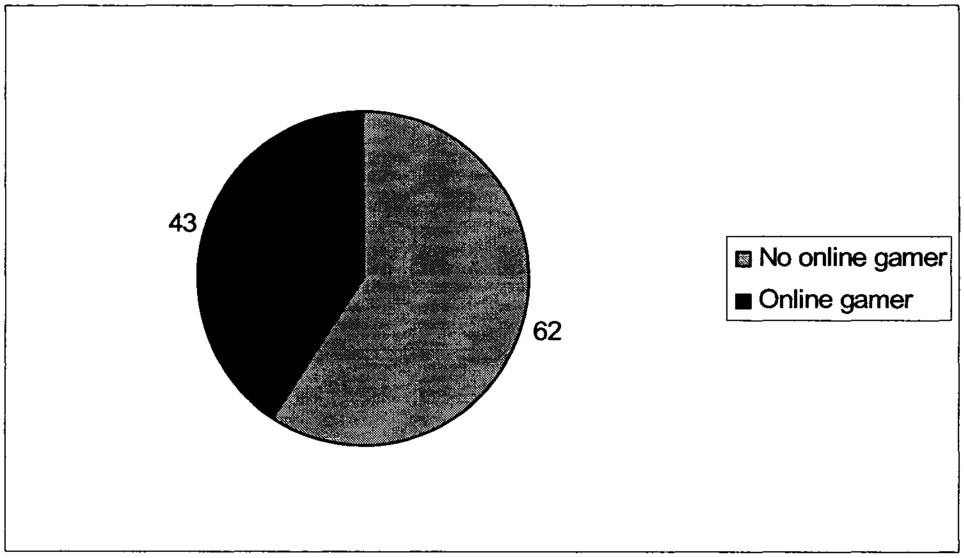


Figure 5.5 Sample of Respondents by online game experience

As show in Figure 5.6, respondents reported their Internet connection types as follow: 47 students use ADSL to connect Internet the same as the number of student using Cable modem, 3 students use Dial-up connection and 1 student uses other ways.

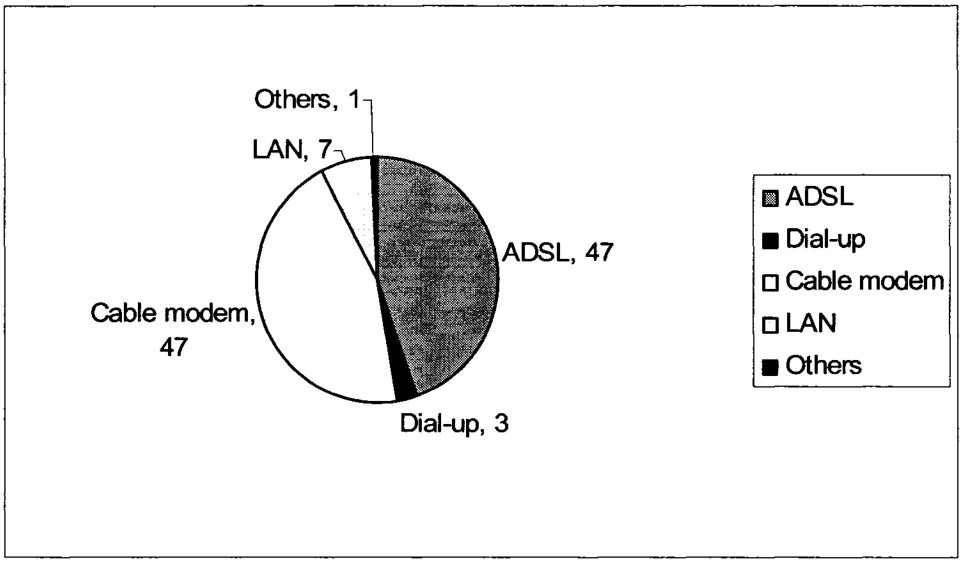


Figure 5.6 Sample of Respondents by Internet connection ways

As shown in Figure 5.7, respondents reported where they usually spend time on this online course as follow: 100 students study this course at home and 5 students spend their time on campus to study this course usually. Although we also provide options, Net Café and Others, to students, no one selects these options.

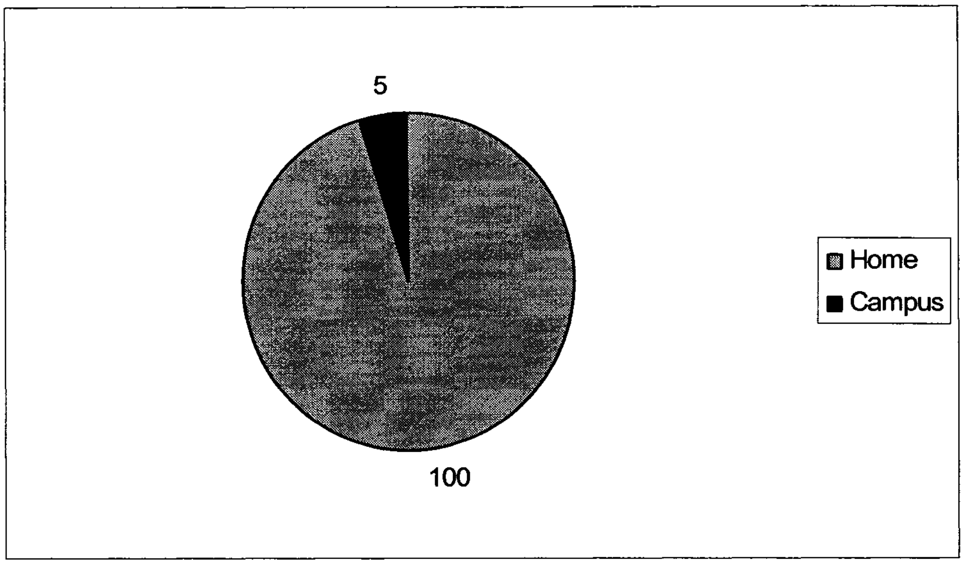


Figure 5.7 Sample of Respondents by study place

Figure 5.8 represents the respondents' feedback to indicate to what extent they use the computer to perform the different types of tasks. Auditing seems to be the least activity the respondents want to use computer to perform and more than 50% of the sample use computer to communicate with others.

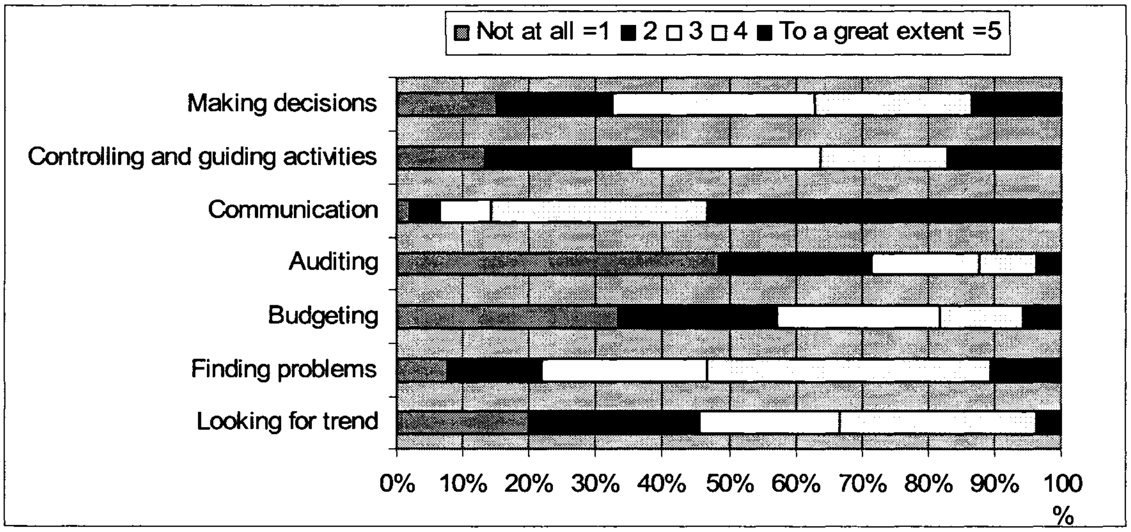


Figure 5.8 Student feedback on types of PC tasks

Figure 5.9 represents the respondents' feedback to indicate to what extent they use the Internet to perform the different types of tasks. More than 50% of the respondents report that they use Internet for information, and some of them don't use Internet for making decision and market analysis at all.

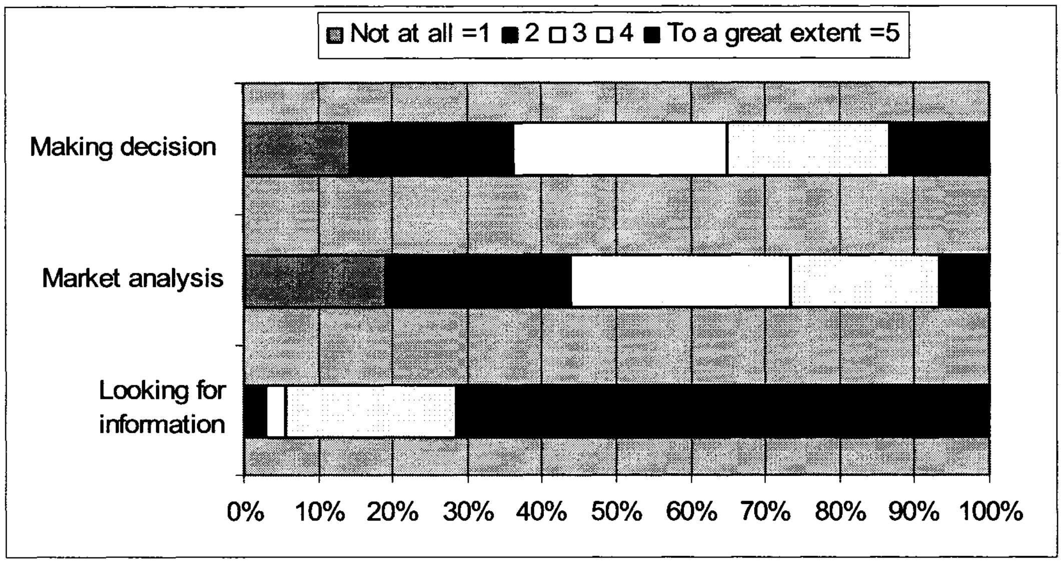


Figure 5.9 Student feedback on types of Internet tasks

Other sample characteristics are shown in Table 5.1.

Table 5.1 Sample characteristics

	Min	Max	Mean	Standard Deviation	Missing
Age	18	51	22.8	4.73	26
Work experience	0	30	6.38	4.66	44
Daily PC usage	1	5	3.99	1.05	0
Usage frequency	2	5	4.10	0.89	0
Daily Internet usage	1	5	3.83	1.02	0
Usage frequency	2	5	4.2	0.85	0
				Note: the table below explain the values	

	Scale				
Daily usage	1	2	3	4	5
	Almost Never	Less than 1 hour	1-2 hours	2-3 hours	More than 3 hours
Usage frequency	1	2	3	4	5
	Rarely	Sometime	Often	Regularly	All the time

We also gathered respondents' computing backgrounds from three aspects in terms of Internet, software and mobile. Specifically, for software, we list 12 activities: word process, spreadsheet, presentations, email, web pages editors, programming languages, graphics, image editing, sound editing, multimedia development, databases, video editing. For Internet, we list 18 activities: web search engines, shopping, downloading music, voice while chatting, voice over IP, courses/learning, banking, forums, video while chatting, buying and selling shares, entertainment, reservations, wikipedia, text and voice as well as video at the same time while chatting, betting, job search, chat, do your taxes. For Mobile, we list 14 activities: agenda/time organizer, download music, friend's dictionary, download video clips, text messaging, download ring tones, take pictures, games, web browsing, email, take videos, paying bills, alarm, record sound. Indeed, we detailed these aspects at three different contexts, home, school and work.

Table 5.2 Computing backgrounds of respondents

Contexts	**Number**	**Top activity for each aspect**		
		Software	Internet	Mobile
Home	105	Email/word processing (100/100)	Web search engines (96)	Text messaging (73)
School	57	Email/word processing (55/55)	Web search engines (55)	Text messaging (37)
Work	36	Email (29)	Web search engines (26)	Text messaging (13)

As shown in Table 5.2, email and word processing are primary activities for respondents using software at home, school, and work. Indeed, top activities of Internet and Mobile usage are web search engines and text messaging, respectively.

On average, the respondents have a reasonable level of experience with computing technology and technology-mediated learning systems and are thus likely to possess well-formed beliefs towards online learning systems in general.

5.2 Descriptive statistics

Prior analyses, a total number of 3 reverse items in the survey are adjusted (Focused Immersion 4, Control 2, Heightened Enjoyment 3). Descriptive statistics for the research constructs are shown in Table 5.3. The means that presented were calculated prior to any removal of items due to reliability analysis.

Table 5.3 Descriptive statistics

Constructs	Mean	Standard Deviation
Ease of Use (PEU)	3.39	1.07
Perceived Usefulness (PU)	3.41	0.99
Attitude (ATT)	3.64	0.92
Behavioral Intention (BI)	3.60	0.92
Subjective Norm (SN)	3.20	0.89
Perceived Behavioral Control (PBC)	3.71	0.92
CA: Temporal Dissociation (TD)	3.10	0.99
CA: Focused Immersion (FI)	3.05	0.93
CA: Heightened Enjoyment (HE)	3.33	1.03
CA: Control (CO)	3.25	0.92
CA: Curiosity (CU)	3.07	0.95
Note: All constructs are five-point scales with the anchors 1 = strongly disagree, 3 = Neutral, 5 = Strongly agree.		

Measure validation and structural model testing were conducted using Partial Least Squares (PLS) Graph Version 2.91.03.04 (Chin & Frye, 1998), a structural equation modeling tool that utilizes a component-based approach to estimation. PLS is a second-generation multivariate technique permitting the validation of the psychometric properties of the scales used to measure a variable, as well as the strength and direction of the relationships among variables. Unlike covariance-based SEM tools, such as EQS, using a maximum likelihood function to obtain parameter estimates, the component-based PLS uses a least squares estimation procedure, allowing the flexibility to represent both formative and reflective latent constructs, while placing minimal demands on measurement scales, sample size, and distributional assumptions (Chin, 1998a; Falk & Miller, 1992; Fornell & Bookstein, 1982). The usual criteria on the sample size to use PLS is that the number of record should be at least ten times larger than the number of items contained in the "largest" construct. In the present study, the most number of items for a particular construct was 5 (Temporal Dissociation and Focused Immersion). Therefore, the sample size of 105 was large enough for this process.

5.3 Psychometric Properties of Measures

Before testing the hypothesized structural model, psychometric properties of the measures for the seven latent constructs measured by self-report questionnaires were evaluated through confirmatory factor analysis using a measurement model in which the first-order latent constructs were specified as correlated variables with no causal paths. The measurement model was assessed by using PLS to examine internal consistency reliability and convergent and discriminant validity (Barclay et al., 1995; Compeau et al., 1999). Internal consistency reliability (also known as composite reliability) was computed from the normal PLS output using the following formula: ICR = $(\Sigma\lambda_i)^2/[(\Sigma\lambda_i)^2+\Sigma(1-\lambda_i^2)]$ where λ_i is the standardized component loading of a manifest indicator on a latent construct (Gefen & Straub, 2005). Internal consistencies of 0.70 or higher are considered adequate (Agarwal & Karahanna, 2000; Barclay et al., 1995; Fornell & Larcker, 1981). Two criteria is necessarily applied to establish convergent and discriminant validity in the measures: (1) The square root of the average variance extracted (AVE) by a construct from its indicators should be at least 0.707 (i.e., AVE > 0.50) and should be much larger than any correlation among any pair of latent constructs (Agarwal & Karahanna, 2000; Gefen & Straub, 2005) and (2) standardized item loadings (similar to loadings in principal components) should be at least 0.707, and items should load more highly on their own theoretically assigned constructs than on other constructs in the model (Gefen & Straub, 2005). The square root of the AVE was computed from normal PLS output by taking the square root of the following formula: AVE = $(\Sigma\lambda_i^2)/[(\Sigma\lambda_i^2)+\Sigma(1-\lambda_i^2)]$. Cross-loadings were computed by calculating the correlations between latent variable component scores and the manifest indicators of other latent constructs. These criteria for reliability and convergent and discriminant validity should be applied only for latent constructs with reflective indicators, and are not appropriate for formative indicators (Chin, 1998b; Gefen et al., 2000).

Table 5.4 shows internal consistency reliabilities, and AVE and correlations among latent constructs. The correlations in Table 5.5 were generated by PLS, and the remaining indices were computed using Excel and SPSS on the PLS output following methods in (Gefen & Straub, 2005). The Confirmatory Factor Analysis (CFA) results can be seen in Table 5. 5.

Table 5.4 Inter-construct correlations

-	ICR	BI	ATT	SN	PBC	PU	PEU	CA: HE	CA: CU	CA: TD	CA: FI	CA: CO
BI	0.95	**0.949**										
ATT	0.94	0.657	**0.916**									
SN	0.95	0.545	0.456	**0.956**								
PBC	0.91	0.649	0.597	-0.37	**0.875**							
PU	0.96	0.636	0.666	-0.565	0.608	**0.933**						
PEU	0.93	0.544	0.532	-0.3	0.742	0.679	**0.881**					
CA: HE	0.9	0.439	0.409	-0.357	0.389	0.667	0.418	**0.865**				
CA: CU	0.94	0.364	0.283	-0.39	0.203	0.53	0.291	0.716	**0.922**			
CA: TD	0.9	0.229	0.207	-0.27	0.074	0.402	0.15	0.53	0.652	**0.804**		
CA: FI	0.89	0.395	0.317	-0.366	0.161	0.487	0.249	0.667	0.732	0.659	**0.794**	
CA: CO	0.76	0.395	0.328	-0.294	0.431	0.505	0.514	0.552	0.564	0.375	0.499	**0.736**

The bold numbers on the diagonal are the square root of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs.

BI = Behavioral Intention; ATT = Attitude; PBC = Perceived Behavioral Control; PEU = Perceived Ease of Use; SN = Subjective Norm; PU = Perceived Usefulness; TD = Temporal Dissociation; FI = Focused Immersion; HE = Heightened Enjoyment; CO = Control; CU = Curiosity

Table 5.5 Factor structure matrix of loadings and cross-loadings

Scale Items	BI	ATT	SN	PBC	PU	PEU	HE	CU	TD	FI	CO
BI1	**0.9579**	0.6361	0.4916	0.6258	0.6425	0.5615	0.4516	0.3411	0.2031	0.397	0.3624
BI2	**0.9579**	0.6233	0.5528	0.6183	0.5767	0.4808	0.3901	0.3571	0.236	0.3594	0.395
ATT1	0.6161	**0.9257**	0.4284	0.4825	0.623	0.4499	0.3693	0.2206	0.2071	0.28	0.2916
ATT2	0.5433	**0.9217**	0.3744	0.4903	0.6066	0.5086	0.4162	0.3057	0.1958	0.3231	0.2971
ATT3	0.6594	**0.9281**	0.4587	0.6749	0.6174	0.5184	0.3535	0.2629	0.1718	0.2799	0.3211
SN1	0.5178	0.4388	**0.9634**	0.3581	0.553	0.3201	0.3583	0.3762	0.2702	0.3411	0.2956
SN2	0.5339	0.4412	**0.9662**	0.3563	0.5373	0.2592	0.332	0.3765	0.2512	0.3646	0.2726
PBC1	0.5702	0.5089	0.2657	**0.8519**	0.531	0.6793	0.3244	0.1152	0.0342	0.0708	0.3163
PBC2	0.5601	0.519	0.3723	**0.9067**	0.528	0.6892	0.2782	0.2181	0.0746	0.1316	0.4305
PBC3	0.5901	0.5529	0.3434	**0.8919**	0.553	0.6011	0.424	0.2053	0.0864	0.2205	0.3971
PU1	0.5623	0.5785	0.5554	0.5612	**0.9298**	0.665	0.5714	0.5189	0.3763	0.4639	0.4223
PU2	0.5906	0.6162	0.5277	0.5471	**0.95**	0.6034	0.6444	0.5024	0.3598	0.4293	0.4447
PU3	0.5706	0.5948	0.552	0.5341	**0.9641**	0.5973	0.6264	0.5014	0.4257	0.4719	0.4759
PU4	0.6646	0.7067	0.4973	0.6407	**0.9245**	0.6872	0.6636	0.4769	0.354	0.4687	0.5489
PEU1	0.4697	0.4199	0.2032	0.6349	0.6003	**0.8775**	0.3972	0.2636	0.1775	0.2052	0.4669
PEU2	0.4354	0.4185	0.2724	0.6603	0.5856	**0.8843**	0.3908	0.3	0.1311	0.2221	0.4447
PEU3	0.574	0.5113	0.318	0.6829	0.6615	**0.9053**	0.3776	0.2475	0.1206	0.2844	0.4643
PEU4	0.4488	0.538	0.2688	0.6616	0.5656	**0.8906**	0.3219	0.2277	0.1057	0.1714	0.4542
HE1	0.3585	0.3558	0.3355	0.315	0.5529	0.334	**0.9172**	0.7171	0.5482	0.6763	0.4746
HE2	0.4018	0.3641	0.3249	0.4086	0.581	0.4348	**0.8976**	0.6399	0.4902	0.561	0.5443
HE3R	0.3862	0.3495	0.2749	0.2879	0.6081	0.3175	**0.8011**	0.5198	0.3497	0.5122	0.4193
CU1	0.3822	0.3092	0.3374	0.2316	0.5416	0.2922	0.7254	**0.9353**	0.6135	0.7057	0.5433
CU2	0.3106	0.2315	0.4194	0.1031	0.4298	0.1967	0.5847	**0.9093**	0.6583	0.6781	0.4902
CU3	0.3186	0.2432	0.3464	0.2149	0.4963	0.3097	0.6736	**0.9477**	0.56	0.6626	0.5359
TD1	0.226	0.1425	0.2401	0.0798	0.3439	0.1432	0.502	0.5899	**0.8726**	0.5668	0.3426
TD2	0.1799	0.2018	0.1768	0.0461	0.3913	0.1747	0.4711	0.6252	**0.9172**	0.6194	0.3411
TD3	0.2693	0.2723	0.3034	0.1229	0.3966	0.2013	0.4841	0.5959	**0.9155**	0.5935	0.4134
TD4	0.1045	0.0169	0.1833	-0.0702	0.1725	-0.0793	0.283	0.3686	**0.6835**	0.4071	0.1307
TD5	0.0558	0.0674	0.1891	0.0202	0.2129	-0.04	0.3408	0.3541	**0.6199**	0.4455	0.133
FI1	0.2696	0.2263	0.306	0.0242	0.3988	0.2153	0.4652	0.545	0.6151	**0.8505**	0.3549

Table 5.5 continued											
FI2	0.3622	0.3063	0.2788	0.1626	0.4449	0.2167	0.6319	0.7015	0.6064	**0.9209**	0.4213
FI3	0.4044	0.3375	0.3602	0.2231	0.5357	0.2555	0.6884	0.7671	0.6219	**0.9327**	0.5247
FI4R	0.3033	0.1907	0.2351	0.1794	0.1831	0.152	0.3628	0.2202	0.1246	**0.4081**	0.2425
FI5	0.2232	0.1544	0.2851	0.032	0.2524	0.1222	0.4362	0.5372	0.5312	**0.7801**	0.4124
CO1	0.3621	0.3021	0.3019	0.4126	0.4642	0.4792	0.5532	0.6218	0.4304	0.5413	**0.8869**
CO2R	0.2617	0.2309	0.0783	0.3002	0.2189	0.2529	0.1737	-0.0322	-0.1952	-0.037	**0.3591**
CO3	0.2519	0.1987	0.2194	0.2443	0.3906	0.372	0.4104	0.48	0.4063	0.4415	**0.8605**

BI = Behavioral Intention; ATT = Attitude; PBC = Perceived Behavioral Control; PEU = Perceived Ease of Use; SN = Subjective Norm; PU = Perceived Usefulness; TD = Temporal Dissociation; FI = Focused Immersion; HE = Heightened Enjoyment; CO = Control; CU = Curiosity

The internal consistency reliabilities were all at least 0.76, exceeding minimal reliability criteria (Table 5.4). As strong evidence of convergent and discriminant validity: (1) The square root of the average variance extracted for each construct (Table 3 diagonal elements) was greater than 0.707 (i.e., AVE > 0.50) and greater than the correlation between that construct and other constructs (without exception) (2) the factor structure matrix (Table 5.5) shows that all items except for one item in control (CO2), two items in Temporal Dissociation (TD4 and TD5) and one time in Focused Immersion (FI4) exhibits high loadings on their respective constructs and no items loaded higher on constructs they were not intended to measure. Overall, these results exhibit sufficiently strong psychometric properties to support valid testing of the proposed structural model.

5.4 Test of Model and Hypotheses

The PLS structural model and hypotheses were assessed by examining path coefficients (similar to standardized beta weights in a regression analysis) and their significance levels. All of the constructs were modeled as reflective and most of them were measured using multiple indicators except for the five cognitive absorption dimensions. Because of PLS-Graph (Version 2.91.03.04) dose not directly support second order factors, it is necessary to transform these first order dimensions comprising CA. A factor score of each dimension are calculated based on the weighted sum (using the weights PLS provides when running the measurement model) of the construct's indicators (Agarwal & Karahanna, 2000). Then these computed first-order factor scores are treated as manifest indicators of CA in the structural model test.

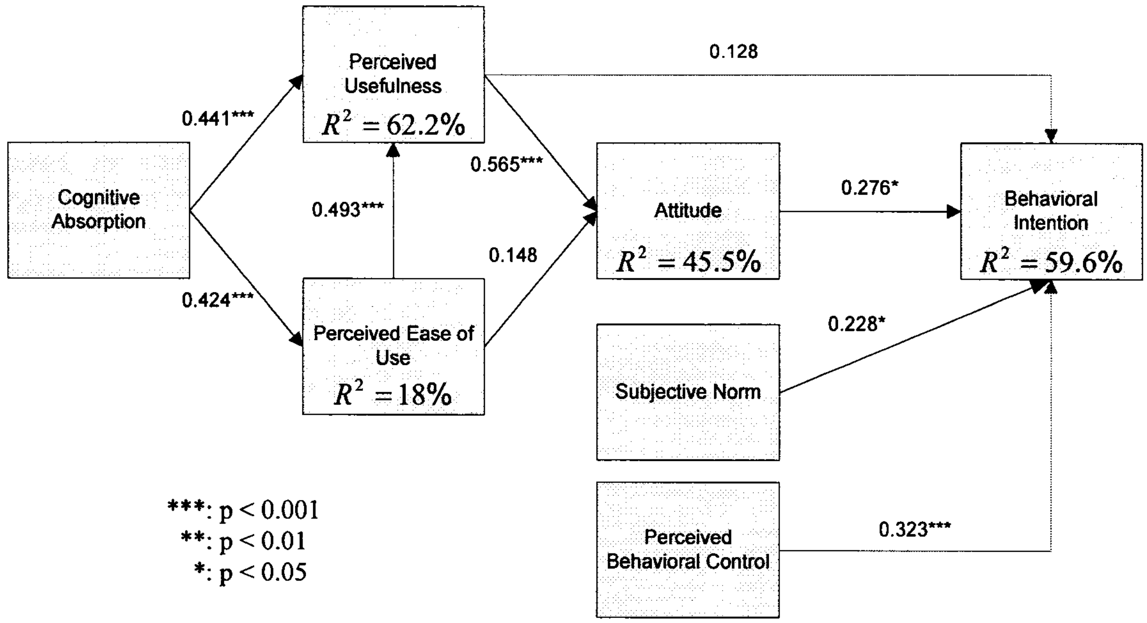


Figure 5.10 PLS results of the research model

Figure 5.10 summarizes model-testing results. The results provide strong support for hypotheses 1, which were essentially drawn from the specification of the TAM except for 1b and 1c. Supporting Hypothesis 2a, SN had a significant effect on BI (β=0.228, p < 0.05). Supporting Hypothesis 2b, PBC had a significant effect on BI (β= 0.323, p < 0.001). Hypotheses 3a and 3b were significantly supported: CA has substantial influence on both of PU (β = 0.441, p < 0.001) and PEU (β= 0.424, p < 0.001). Summarized results for the hypothesis tests are shown in Table 5.6.

Table 5.6 Summary of results

Hypothesis	Support
H1a: PEU → PU	Supported
H1b: PU → BI	Not supported
H1c: PEU → ATT	Not supported
H1d: PU → ATT	Supported
H1e: ATT → BI	Supported
H2a: SN → BI	Supported
H2b: PBC → BI	Supported
H3a: CA → PU	Supported
H3b: CA → PEU	Supported

Cognitive absorption and ease of use jointly explain 62.2% of the variance in usefulness, while 18% of the variance in ease of use is explained by Cognitive absorption alone. Perceived usefulness and ease of use account for 45.5% of the variance in attitude toward technologies. Finally, consistent with the formulation of theory of planned behavioral, 59.6% of variance in behavioral intention is explained by attitude, subjective norm and perceived behavioral control together.

A series of ad hoc analysis were conducted in order to explore the potential relationships among research constructs. First, we investigate the direct relationship between CA and behavior intention (Figure 5.11). Contrary to previous studies (Agarwal & Karahanna, 2000; Saadé & Bahli, 2005), there was no significant direct path from CA to BI supporting a full mediation of the effects of CA on BI by beliefs of usefulness and ease of use.

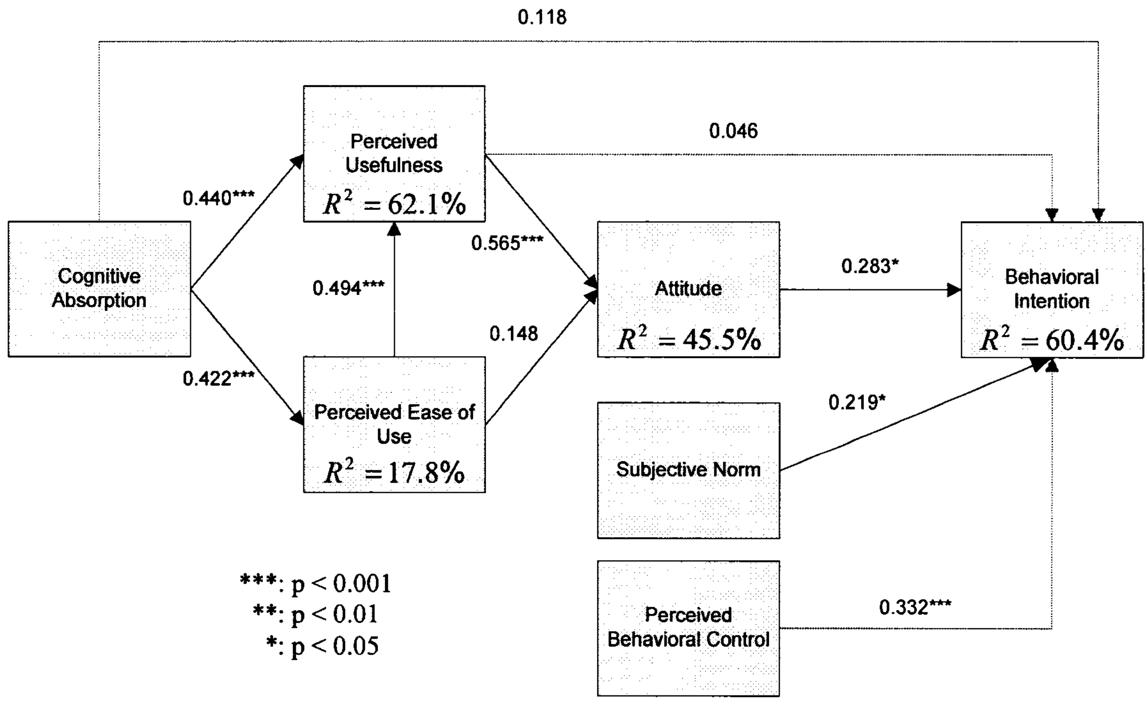


Figure 5.11 Results of the research model (With Direct effects)

Second, prior research suggests that users' pervious experience with using systems would lead to formulate attitude (Fazio & Zanna, 1981). In addition, it has been argued that users' previous general computing experience with computers would influence their perceptions of usefulness and ease of use of specific systems positively (Ndubisi et al., 2003). In this study, we used respondents' feedback on daily Internet and computer usage, and frequencies of Internet and computer use to refer their hands-on experience with online learning systems. We investigated the relationships among computing experience, perceived usefulness, perceived ease of use and attitude (See Figure 5.12). However, from the analysis, the computing experience doesn't have significant influence on users' beliefs and attitude.

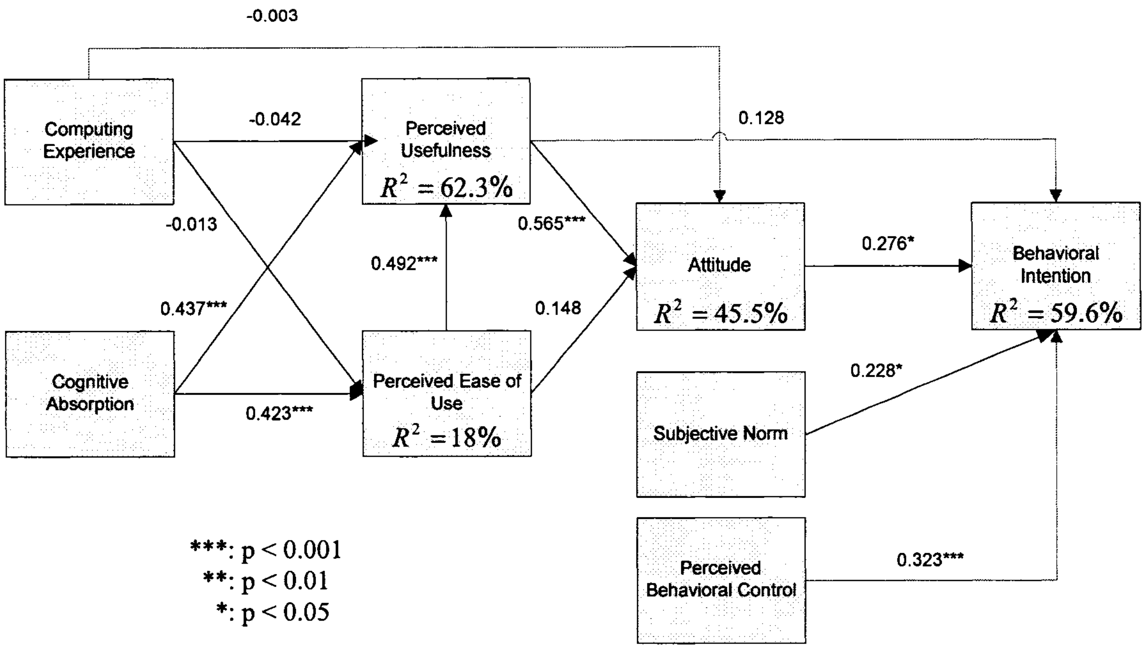


Figure 5.12 Results of the research model (With Computing Experience)

Third, researchers (Lucas & Spitler, 1999; Straub et al., 1995) cautioned that under certain conditions, self-reported measures may not be valid indicators of use. Szajna (1996), in a test of a modified version of TAM, also argued in favor of actual use with TAM in a study of students using email. In our study, we save students' access records in terms of access time and duration of use. All the survey participants accessed and used the system (Table 5.7).

Table 5.7 Actual system usage summary

	Min	Max	Mean	Standard Deviation
Access times	1	35	6.36	4.8
Usage (Minute)	0	124	15.4	16.9

Then we conducted regression analysis for behavioral intention on actual system usage. The result suggests that the prediction ability of behavioral intention on actual system usage is relative weak and the explained variance of actual usage is small (see Figure 5.13).

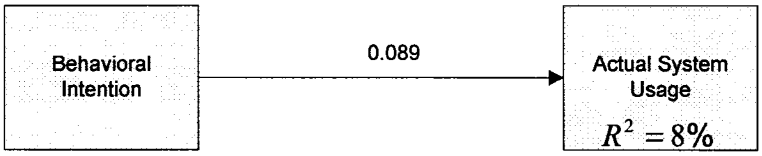


Figure 5.13 Result of Intention and actual usage test

6 DISCUSSION AND CONCLUSIONS

The present section summarizes the findings of this thesis. Corresponding explanations about results and their implications for research and practice are examined. Limitations and future research directions are also discussed

6.1 Summary of findings

The objectives of the present study were to propose and perform an initial test of a new theoretical model of individual' behavioral intention towards the technology-mediated learning environment. Specifically, the aim is to investigate the mechanism of individual acceptance behavior integrating both of rational/analytical aspect and affective/holistic experience during the use of information technologies for learning activities. The advantage of empirically exploring the effects of the two mechanisms simultaneously within a unitary model is that it facilitates understanding of the entire individual acceptance behavior influenced by various e-learning characteristics which were scattering in previous study.

Of the nine hypothesized relationships seven were found to be as expected. The formulation of TPB provides insights into what influences individual behavior. Subjective norm (perceived social expectations regarding adoption), attitude (anticipation of positive or negative consequences after adoption), and perceived behavioral control (the perceived obstacles or facilitators to adoption) are significantly and positively associated with behavioral intention. Moreover, cognitive absorption has significant and strong influence on beliefs and its impact on behavioral intention is fully mediated by the beliefs. In consistent with prior studies, the usefulness beliefs were influenced by ease of use perceptions. And individuals' assessments of instrumental outcomes would increase the positive level of attitude towards the system use.

While the empirical findings of the study provide some support for the overall structure posited in the research model, some relationships among variables are opposite to what was hypothesized. There is no direct relationship between the usefulness belief and behavioral intention but attitude mediates their relationship. Although attitude was dropped from the specification of the original TAM (Davis et al., 1989), many empirical findings support the importance of attitude as a construct mediating effects of beliefs on the acceptance behavior (Heijden, 2003; Hsu & Lu, 2004; Lee et al., 2005; Moon & Kim, 2001). Moreover, contrary to our expectations, we surprisingly discover the ease of use belief hasn't influence attitude in our research model. The fact suggests that, for this sample, the cognitive resources released by an ease to use technology are not important to individual's conception assessment of technologies. One possible explanation for this unexpected finding is that the system is perceived to be inherently easy to use, thereby the level of released cognitive burden is not significant enough to transfer its effect on attitude (Lewis et al., 2003). However, given that the mean value of ease of use for this sample is above the mid-point of the scale, this explanation is not supported by data. Another explanation probably is that the respondents in the sample were relatively familiar to this type of technologies. Today, the use of information technologies has become a daily routine. Specifically, for this sample, more than 65% of the students have taken online courses using similar systems before. And the average PC daily usage is approximately to 4 out of 5. Several studies have suggested and found similar outcomes that individuals' level of experience and familiarity with the focal technology can influence the strength of relationship in the TAM (Lee et al., 2005; Lewis et al., 2003; Saadé et al., 2007; Teo et al., 1999).

6.2 Limitations

Prior to discussing the implications of our findings, several limitations of the present study should be note when interpreting its findings. First, the specific use of the multimedia learning component to practice certain study content would limit the user's value of the system. The student's value of the system is largely dependent on the importance individual students place on the task in preparing for their finals. In an educational setting such as the context for this study, it is possible that students place greater value on extrinsic rather than intrinsic awards when they perform learning activities (Ryan & Deci, 2000). Second, because of its specificity, caution must be taken in generalizing and applying the results to other technologies and settings. The respondents of this study were students in a business school. Since they were more familiar to the technology-mediated learning systems and experience with information technologies, the generalizability of the respondents' behavior to a more general workforce may be somewhat limited. Another caution, which should be placed to the external validity of this study, is that the issue of respondent age. The average respondent in this sample was 23 years old with an exception that was 51 years old. A moderation effect of age on the effects of the training method and acceptance behavioral towards information technologies was found in previous studies(Venkatesh et al., 2003; Webster & Martocchio, 1995). Therefore, the generalizability of the findings in this work to another age groups needs to be tested in future study.

There were some issues with the multimedia component under investigation. Some students claimed that the system did not perform their "drag" and "drop" activities when they used the workplace to develop ERD. This may disturb respondents' perception and then influence the responses. Furthermore, since this component only includes 3 business cases for practice, the respondents' interaction experience with this component was relatively shorter than their interaction with other parts of the entire system. Thus, the subjective perceptions on the specific component would blur with the boundaries of other components.

The research design was cross-sectional in nature, thereby the extent to which causality can be inferred is limited. Additionally, as data analysis was conducted by PLS-Graph which doesn't directly permit the representation of second-order latent constructs, we were unable to model the indicators for the five dimension of CA (Agarwal & Karahanna, 2000; Yi & Davis, 2003).

6.3 Implications for research

This study was motivated by the increasing need of using information technology as a core component of high education and training programs, and managers and researchers look for better understanding of what drives individual behaviors toward such learning environments. Arguing that individuals make adoption and usage decisions with their rational assessment and holistic experience about IT use, we sought to offer a unified perspective on the factors that influence an individual's behavioral intention. To this end, we examined the joint effects of two critical sets of mechanisms: belief-intention models and intrinsic motivation in the context of a single empirical research investigating the utilization of a technology-mediated learning environment by students. Results provide strong support for the posited relationships. Indeed, the highly explained variance of individual acceptance behavior affirms the value of this incorporating model as a theoretical platform for future research on TML.

Several theoretical and practical implications follow. From the perspective of theory advancement, we provide a solid empirical support regarding critical predictors of individual behavior in technology acceptance. With our unified model, approximate 60 percent of the intention has been explained, suggesting that the model servers as an adequate conceptualization of the phenomenon of interest. Researchers have conducted lots of studies by only following one or the other theoretical mechanism to explain technology use behaviors, but limited work has specifically examined the effects of both of them together. This result is in accordance with pervious research on web-based training system based on flow theory and TRA (Choi et al., 2006). The integration of individual's affective and holistic experience would be useful for understanding some non-beneficial or addictive human behavior that is difficult to explain with only the avenue of individual's rationality.

Second, we empirically validated the significant mediation effect of attitude towards technology acceptance behavior. This controversial finding that attitude mediates impacts of individual's beliefs on behavioral intention has been fully supported by studies purely applying TPB and TRA, but is inconsistent with results from researches of TAM which is a theoretical adaptation of TRA. For example, Taylor and Todd (1995) found that attitude is not an determinant of intention and usage when they applied TAM only to explain students' decision to use a computer resource center. Indeed, Davis et al (1989) explained this relationship as an outcome of individual's priority of consideration. In workplace settings, people form intention towards behaviors they could achieve various instrumental rewards. Consequently, these behaviors don't require a reappraisal of how the instrumental reward "contributes to purposes and goals higher in one's goal hierarchy, and there fore without necessarily activating the positive affect associated with performance-contingent rewards"(Davis et al., 1989, p. 986). However, in the following test of TPB model in Taylor and Todd's study, attitude, subjective norm and perceived behavioral control all had significant effects on behavior. Paying close attention to the formation of attitude would assist the explanation of these inconclusive findings. One's affect needs to be fully activated by positively valued outcomes after the specific behavior performance, in order to make one's attitude completely capture the influence of performance considerations on one's intention. In TAM, the significant impact of extrinsic awards leads people form directly and immediately intention toward means-end behaviors, before the generation of attitude which is a function of the products of behavioral beliefs and outcome evaluations much more than the usefulness belief. Although TAM successfully predicts individual acceptance behavior on information technologies in many performance-orientated settings with the Davis et al's argument, the absence of attitude ignores potential impacts of external factors that activate people's affect leading to final behavior not only in performance-orientated environment but also entertainment-orientated settings. Especially, for entertainment-orientated technologies, the effects of instrumental awards get lower priority of consideration. In present study, the aim of the multimedia learning component blurs the boundaries of the two types of perspectives making attitude become a salient predictor of individual behavior.

Third, we found a substantial influence of subjective norm on behavior intention. In order to examine impacts of social factors on individual intention in a more real context, we let student use the system voluntarily over a period of time to capture others' opinions. Students are likely to use the system due to influences from the instructor and pressure as well as recommendations from their peers. In Lapointe and Rivard's study (2007), they found people would drop their system use when they felt that resistance with their colleagues served a better interest, even though they perceived the system as useful and easy to use. In contrast, someone eventually accepted a system without experience of ease of use and usefulness on it, but influences at organization level. These findings support Davis et al.'s suggestion (1992) that the power of social variables is more influential in realistic organizational settings.

Forth, this study empirically contributes to the development and refinement of cognitive absorption and affirms its highly significant relationships with crucial beliefs driving technology acceptance behavior. Although this construct captures more holistic experience than other intrinsic motivators, empirical studies are scarce. In regard to theoretical advancement, we extended the line of work on this conceptual construct. For the psychometric properties of the CA construct, we found encouraging results of in the measurement test. However, two reverse scaled items (CO2 and FI4) were much lower than expectation level. This finding is in accordance with Agarwal and Karahanna's initial assessment on the CA construct. Therefore, to replace the two by positively worded items in future study would verify the effects of the reverse coded items on the uni-dimensionality of the underlying scale. In consistent with previous research, our study showed that when students experience a total engagement with the learning system and enjoy the process to meet their intrinsic needs a behavioral intention of use would form as a consequence.

Finally, from the perspective of education, we get a greater depth and breadth on understanding of technology-mediated learning. Alavi and Leidner (2001) encouraged researchers to formulate research questions in terms of the way in which technology features can engage psychological processes of learning. In our study, we initially described one psychological process from motivation aspect. People have a natural wellspring of learning and achievement but their learning procedure is managed by the external education system. The multimedia learning component, which embeds the instructional strategy of utilizing intrinsic motivation, catalyzes students' learning activities in this system, due to the pursuit of study performance or the pleasure dimension of study and play, or both of them.

6.4 Implications for practice

From a pragmatic perspective, three important implications follow. First, our results point to the importance of integrating hedonic elements into system interface design. While aims of the implementation of information systems emphasize the productivity-oriented perspective, the importance of experiences that intrinsically motivating in work can not be ignored. Experience such pleasure, enjoyment, and fun during the interaction could increase the system usage leading to substantial work outcomes. Managers need to eschew a strictly utilitarian perspective on work, and encourage the positive influences of hedonic nature of information systems. Users need to bravely explore new IT in regard to enjoy pleasure aspect of their work.

A second important implication for practice relates to prescriptions about the learning system development and training programs design. Nowadays, various information technologies are available to develop learning systems, technologies whose features provide a sense of being in command of interaction, visually rich and appealing should get more attention. While the cost of employee training is quite high (Marakas et al., 1998), any development in improving the training mechanisms for better performance will allow managers to better manage their resources. For program design, the training context should be more enjoyable and provide opportunities for cognitive absorption.

The final implication is useful to organizations to successfully manage their IT implementation. According to our findings, it is evident that the social opinion on technology use seems to be a critical predictor of individual behavior toward information technologies. It suggests that managers need to focus careful attention on creating friendly and positive environment to the new technology. Unless individuals perceived the support on the system from "invisible organization", they are unlikely to adopt it eventually, even though they have positive beliefs on the technology. Therefore, it is necessary and important for technology implementers to assist individuals in developing positive opinion about the technology and involve their commitment into the development.

6.5 Future research directions

Several areas remain for future research. Our study has mainly examined the role of dynamic individual difference, notably the state of cognitive absorption. However, researchers suggest that the dynamic, IT-specific factor is a function of stable individual traits, such as playfulness. By introducing the concept of personal traits into the CA research, we could not only extend the nomological net for CA, but also empirically examine the notion that individuals may inherently differ in their eventual acceptance of new information technology. Second, for researchers interested in continue this work from motivation perspective, a promising issue relates to the hierarchy of motivation. Ryan and Deci (2000) suggest that people vary not only in the orientation of motivation (intrinsic or extrinsic), but also in level of motivation. Researchers may consider postulating and empirically testing effects of different amounts of motivation on individual behavior. Last but not least, in our study, students use the learning component to perform their learning activities individually. However, as noted earlier, some research has suggested that collaborative instructional strategy would generate more positive outcomes. It would be interesting to examine the finial decisions on technology adoption, when students are allowed to solve a business case in group using the multimedia learning component.

6.6 Conclusion

In conclusion, the primary concern of this study is to get better understanding of individual behavior towards the technology-mediated learning system based on a unified model that synthesized multiple theoretical perspectives. The core formulation of this integrated model argues that individual technology acceptance behavior is a function of their holistic experience with the technology and cognitive perceptions formed by rational assessments. We tested the research model with in context of a single empirical study. Final findings substantially support the theoretical relationships, and allow us to make several theoretical and practical suggestions. The results will help advance our understanding of individual behavioral toward IT especially those used to support learning activities, as technology-based teaching and learning continue to pervade at education field with an accelerating rate.

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APPENDIX A: Consent letter

CONSENT TO PARTICIPATE IN MULTIMEDIA LEARNING ENVIRONMENT

This is to state that I agree to participate in a program of research being conducted by Weiwei Tan of Decision Sciences and MIS department of Concordia University.

A. PURPOSE
I have been informed that the purpose of the research is to enhance capability and functionality of the multimedia learning environment used to teach COMM 301 and to document feedback on the learning tool effectiveness and efficiency for online learning. In addition, part of final data will be used in Mr. Tan's paper for students' usage behavior data analysis under multimedia learning environment.

B. PROCEDURES
The participant will be assigned a survey and needs to click the radio button corresponding to her/his option about each question. The participant can access the system and complete the questionnaire without any time limitation during the survey period. When completed, the participant clicks on a submit button; the questions are saved in a database; and participants are thanked for their participation.

C. RISK AND BENEFITS
Since this survey is voluntary, there is NO risk. On the other side, they can give their concerns and feedbacks about multimedia learning environment.

D. CONDITIONS OF PARTICIPATION
I understand that I am free to withdraw my consent and discontinue my participation at anytime with out negative consequences.
I understand that my participation in this study is totally confidential.
I understand that the data from this study may be published.

NAME: (student ID)

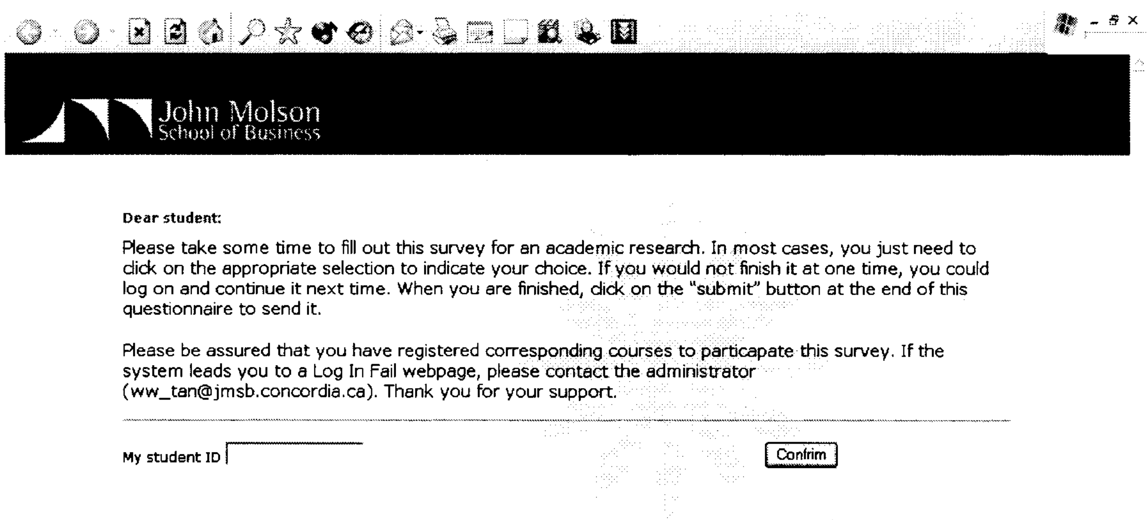
☐ YES, I have carefully studied the above and understand this agreement. I freely consent and voluntarily agree to participate in this study.

☐ NO, I don't want to participant this survey.

Confirm

If at any time you have questions about your rights as a research participant, please contact Adela Reid, Research Ethics and Compliance Officer, Concordia University, at (514)848-2424-7481 or by email areid@alcor.concordia.ca.

APPENDIX B: Web-survey Screenshots



John Molson
School of Business

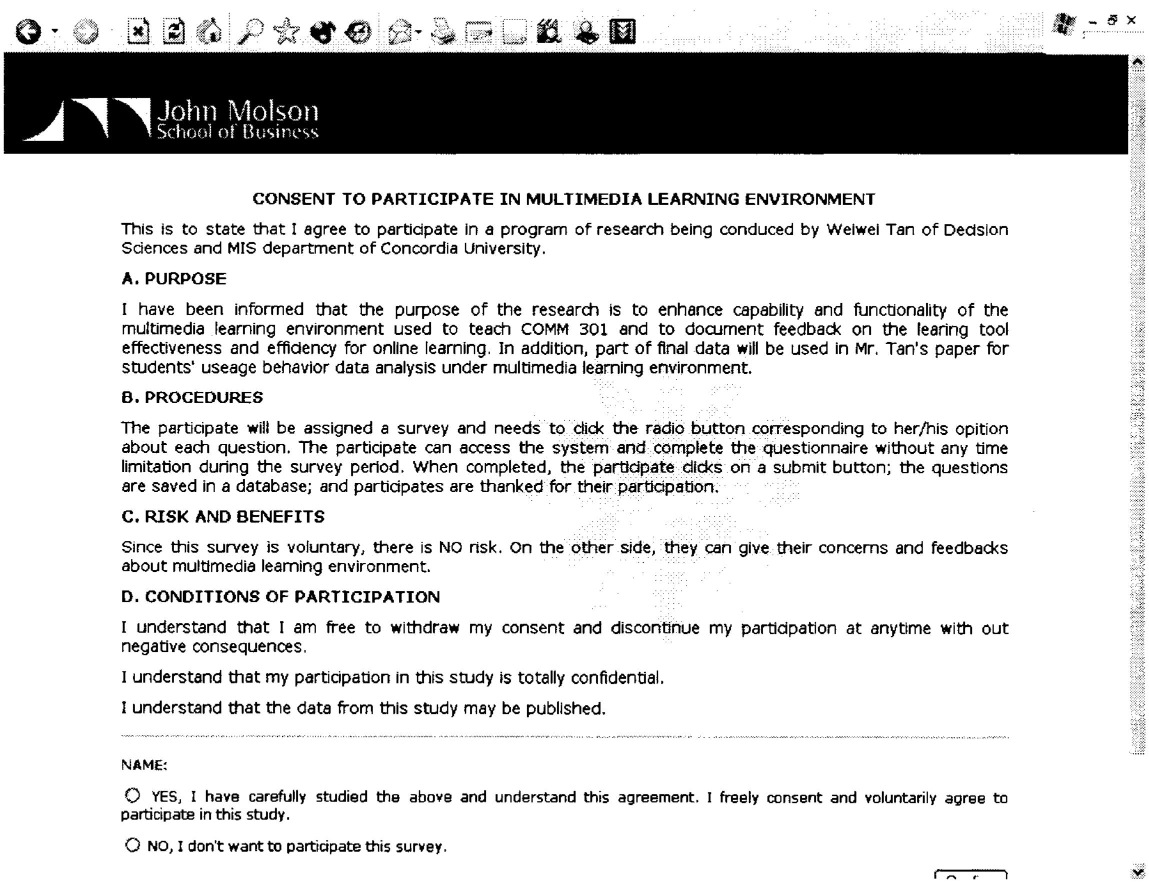
Dear student:

Please take some time to fill out this survey for an academic research. In most cases, you just need to click on the appropriate selection to indicate your choice. If you would not finish it at one time, you could log on and continue it next time. When you are finished, click on the "submit" button at the end of this questionnaire to send it.

Please be assured that you have registered corresponding courses to particapate this survey. If the system leads you to a Log In Fail webpage, please contact the administrator (ww_tan@jmsb.concordia.ca). Thank you for your support.

My student ID ______ [Confirm]

Screenshot 1: Logon Page



John Molson
School of Business

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C. RISK AND BENEFITS

Since this survey is voluntary, there is NO risk. On the other side, they can give their concerns and feedbacks about multimedia learning environment.

D. CONDITIONS OF PARTICIPATION

I understand that I am free to withdraw my consent and discontinue my participation at anytime with out negative consequences.

I understand that my participation in this study is totally confidential.

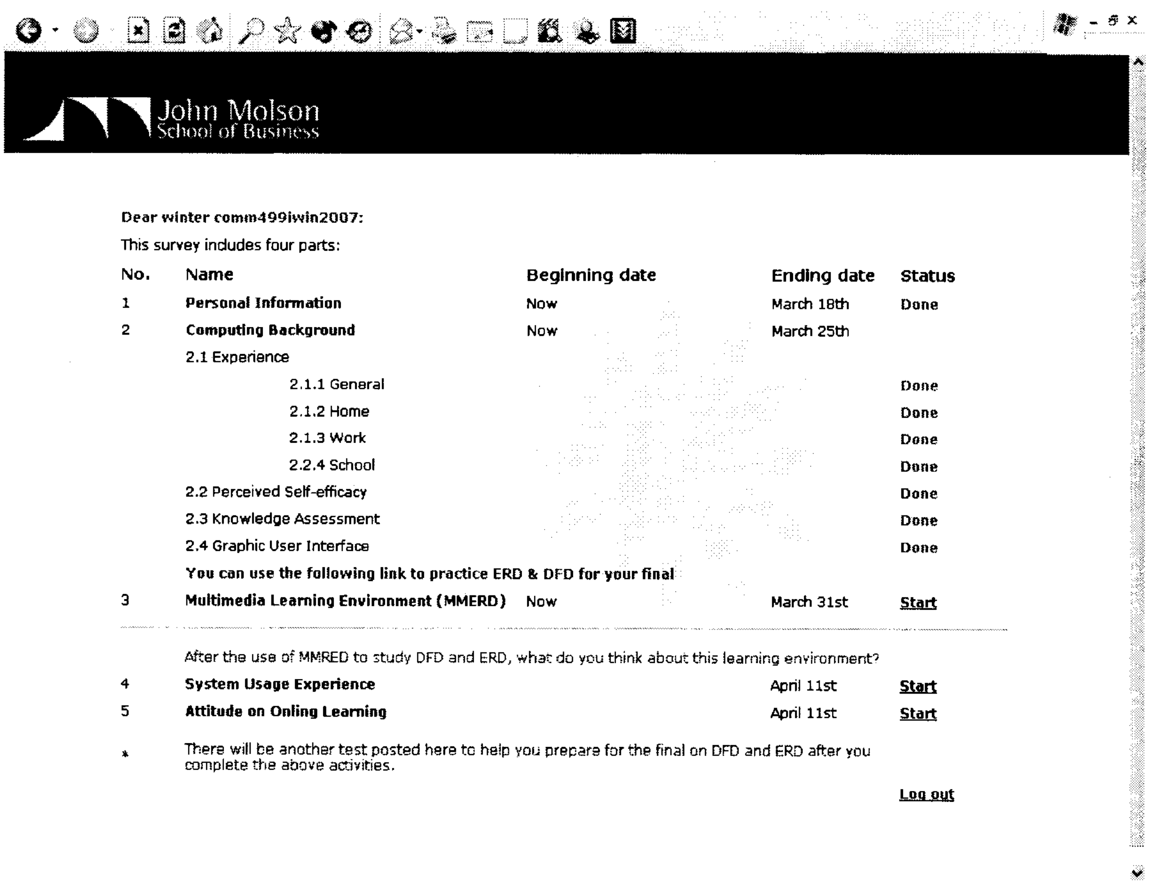
I understand that the data from this study may be published.

NAME:

○ YES, I have carefully studied the above and understand this agreement. I freely consent and voluntarily agree to participate in this study.

○ NO, I don't want to participate this survey.

Screenshot 2: Consent Letter Page



John Molson
School of Business

Dear winter comm499iwin2007:

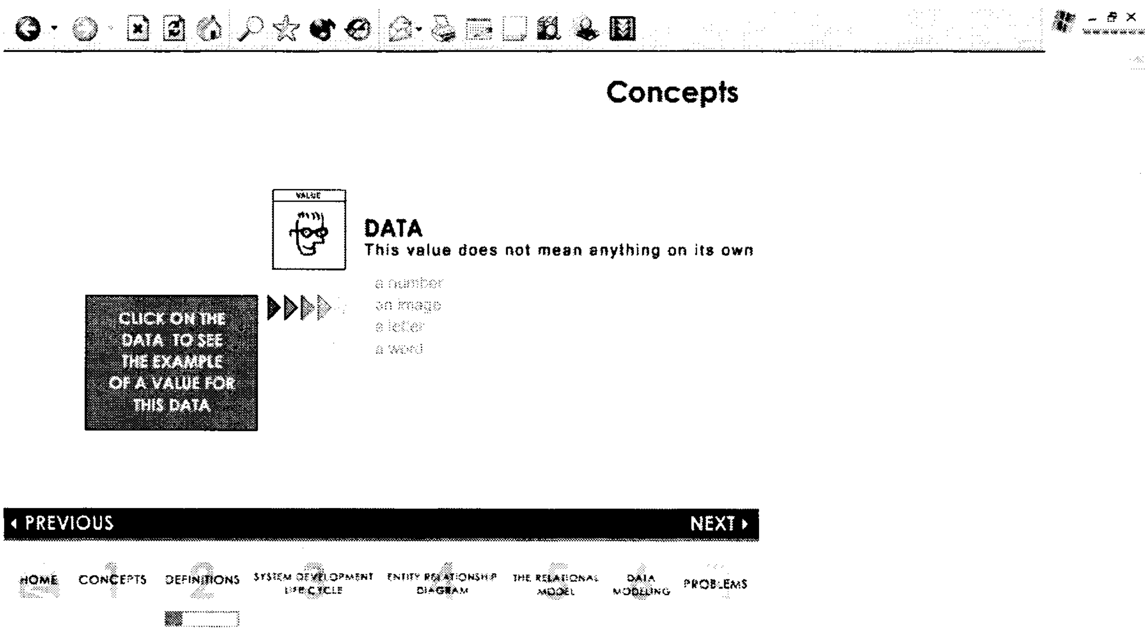
This survey indudes four parts:

No.	Name	Beginning date	Ending date	Status
1	**Personal Information**	Now	March 18th	Done
2	**Computing Background**	Now	March 25th	
	2.1 Experience			
	2.1.1 General			Done
	2.1.2 Home			Done
	2.1.3 Work			Done
	2.2.4 School			Done
	2.2 Perceived Self-efficacy			Done
	2.3 Knowledge Assessment			Done
	2.4 Graphic User Interface			Done
	You can use the following link to practice ERD & DFD for your final			
3	**Multimedia Learning Environment (MMERD)**	Now	March 31st	Start
	After the use of MMRED to study DFD and ERD, what do you think about this learning environment?			
4	**System Usage Experience**		April 11st	Start
5	**Attitude on Onling Learning**		April 11st	Start
*	There will be another test posted here to help you prepare for the final on DFD and ERD after you complete the above activities.			

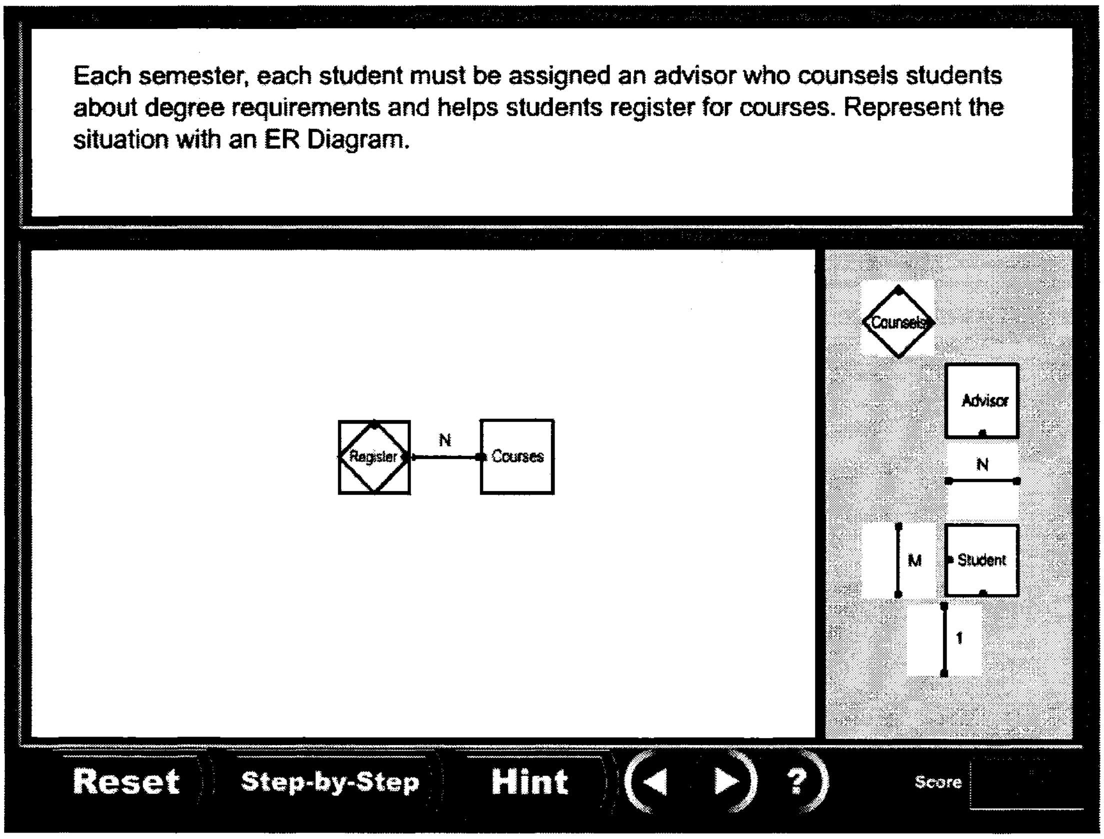
Log out

Screenshot 3: Survey Index

APPENDIX C: Screenshots of MMERD



Screenshot 4: One of presentation slides



Screenshot 5: One of practice problems

APPENDIX D: Measurements

Ease of Use	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Learning to navigate the MMERD is easy for me.	O	O	O	O	O
2. I find it easy to get the MMERD to do what I want it to do.	O	O	O	O	O
3. It was easy for me to become skillful at using the MMERD.	O	O	O	O	O
4. I find the MMERD easy to use.	O	O	O	O	O

Usefulness	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I feel that using the MMERD has improved my performance in the Comm301 course.	O	O	O	O	O
2. Using the MMERD in the comm301 course has improved my productivity.	O	O	O	O	O
3. Using the MMERD has enhanced my effectiveness in the comm301 course.	O	O	O	O	O
4. I find the MMERD useful in the comm301 program.	O	O	O	O	O

Attitude towards the system	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Using web-based learning systems in the Comm301 course were a good idea.	O	O	O	O	O
2. Using web-based learning systems in the Comm301 course were pleasant.	O	O	O	O	O
3. Using web-based learning systems were beneficial to me in the Comm301 course.	O	O	O	O	O

Intentions	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I intend to use "learning tools" frequently whenever they are available.	O	O	O	O	O
2. I intend to be a heavy user of "learning tools" whenever they are available.	O	O	O	O	O

Subjective Norm	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Students who influence my behavior think that I should use the MMERD.	O	O	O	O	O
2. People who are important to me think that I should use the "learning tool".	O	O	O	O	O

Perceived Behavioral Control	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I was able to use the MMERD.	O	O	O	O	O
2. Using the MMERD was entirely within my control.	O	O	O	O	O
3. I had the resources and the knowledge and the ability to make use of the MMERD.	O	O	O	O	O

Curiosity	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Using MMERD in Comm301 stimulates my curiosity	O	O	O	O	O
2. Using MMERD in Comm301 leads to my exploration	O	O	O	O	O
3. Using MMERD in Comm301 arouses my imagination	O	O	O	O	O

Temporal Dissociation	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Time appears to go by very quickly when I am using the MMERD	O	O	O	O	O
2. Sometimes I lose track of time when I am using the MMERD	O	O	O	O	O
3. Time flies when I am using the MMERD	O	O	O	O	O
4. Most times when I get on to the MMERD, I end up spending more time that I had planned	O	O	O	O	O
5. I often spend more time on the MMERD than I had intended	O	O	O	O	O

Focused Immersion	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1.While using the MMERD I am able to block out most other distractions	O	O	O	O	O
2.While using the MMERD, I am absorbed in what I am doing	O	O	O	O	O
3.While on the MMERD, I am immersed in the task I am performing	O	O	O	O	O
4.When on the MMERD, I get distracted by other attentions very easily (R)	O	O	O	O	O
5.When on the MMERD, my attention dose NOT get diverted very easily	O	O	O	O	O

Control	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1.When using the MMERD I feel in control	O	O	O	O	O
2.I feel that I have no control over my interaction with the MMERD (R)	O	O	O	O	O
3.The MMERD allows me to control my computer interaction	O	O	O	O	O

Enjoyment	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. Using MMERD in my learning is fun	O	O	O	O	O
2. Using MMERD in my leaning is enjoyable	O	O	O	O	O
3. Using the MMERD in the Comm301 bores me (R)	O	O	O	O	O

APPENDIX E: Summary of Empirical Research on TML

Authors	Theory	Topic	Subjects	Target system	Findings
(Piccoli et al., 2001)		The assessment of effectiveness of virtual learning system in basic IT skills training	146 undergraduates	Web-based virtual learning system (Lotus Learning Space)	There no significant differences in performance between students who enrolled in VLM environment and students who enrolled in traditional environment. The virtual environment leads to higher reported computer self-efficacy, but participants report being less satisfied with the learning process. Some students found themselves unable to cope with high degree of learner control, that is, a great shift of responsibility from the instructor to themselves and with novelty of the learning environment.
(Alavi, 1994)	Cognitive learning theory & collaborative learning theory	A evaluation of classroom experience and student learning via group decision support system in a collaborative learning process	127 MBA students (79 equipped with GDSS)	GDSS software (Vision-Quest)	GDSS-supported collaborative learning leads to higher levels of perceived skill development, self-reported learning, learning interests and evaluation of classroom experience. GDSS-supported students significantly outperformed than their counterparts in the final grades.
(Leidner & Jarvenpaa, 1993)		IT-enabled instructional methods in traditional setting	Case 1: 23 students Case 2: 17 students Case 3: 20 students	IBM AT	Computer-based technology is a means of interactive guided learning and real-time manipulation of data, a flexible learning lab and a display mechanism. Teacher styles and student preference are two important moderators of teaching methods and their effect.
(Lim et al., 1997)		A comparison of the outcomes of two computer learning methods: co-discovery and self-discovery	40 university students	A stimulated electronic mail system implemented on an Apple Macintosh system	Co-discovery subjects formulated mental models that provided grater inference potential, which leads to a better performance on a novel task, than did those of counterparts. Co-discovery students generated

					more and deeper level utterances and thinking
(Alavi et al., 2002)	Social learning theory	An assessment of learning outcomes of two distributed learning environments varying hierarchical characteristics	206 executives from a large federal agency	Level-1 GSS: an e-mail system, and www Level-2 Beta system: an advanced email, a media center, multithreaded discussion capability ect	Participants using the simple GSS had higher learning outcome than did those of users under the more sophisticated GSS Participants at Beta system generated more message on technology sense-making while their counterparts exchanges messages related to learning task. No significant discrepancies was observed in the students' satisfaction with the learning process under two learning environment
(Hiltz & Wellman, 1997)		Outcomes of virtual learning environment	692 students	Virtual Classroom	The belonging of "learning communities" facilitated by the system motivates students to work harder and to keep up with the contributions of instructors and classmates
(Goodman & Darr, 1998)		Computer-aided systems in organizational learning	25 employees from a Fortunate 100	Electronic library system & Informal community	Regional computer-aided communities have better performance on organizational learning The characteristics of virtual communities facilitate proceeding of regionally specific problems
(Zhang et al., 2006)	Constructivist learning theory & cognitive information processing theory	Effectiveness of interactive video in e-learning context	138 students randomly assigned to one of four treatment groups	A multimedia e-learning system	Students under e-learning system with interactive video have better learning performance and use satisfaction than those of other groups
(Leidner & Fuller, 1997)	Constructivist learning theory & collaborative learning theory	A learning outcomes comparison between two different learning methods. One with and the other without IT support	80 undergraduates	Group Support System	Students involved IT-enabled collaborative learning have higher levels of interest in learning than individual learners but lower levels of performance. After an individual learning session, students have higher levels of perceived learning when they had

					first interacted in a collaborative learning environment.
(Hiltz, 1986)		Outcomes of IT-enabled learning system	Students	The electronic information exchange system	Only informed and motivated learners can fully get the benefits of increased learner control The system provides better access to professors and higher levels of participation and learning motivation.
(Alavi et al., 1995)	Collaborative learning & Media Richness and TIP	Outcomes of three types of collaborative learning with different levels of technology-mediated	120 MBA students	Desktop videoconferencing	Students in the three learning environment have equal effectiveness of knowledge acquisition and satisfaction of learning process and outcomes. Distant DVC students were more committed and attracted to their group and had higher critical-thinking skills
(Storck & Sproull, 1995)		Outcomes of learning in videoconferences	3 fulltime students and 22 employees	Videoconference classrooms	Participants on remote sites can achieve the same levels of performance as they do in fact-to-fact interaction. Fact-to-face interaction helps people come to know better since the method of video changes patterns of attention to information, with resulting changes in impression formation.
(Choi et al., 2006)	TRA & Flow theory	Determinants of e-learning outcomes	223 vocational students	A web-based e-learning system	Attitude and flow experience mediate the effect of external factor Perceived ease of use of learner interface and content affect attitude and flow simultaneously. Interaction and instructor attitude towards students influence flow experience and instructor technical competence impacts attitude.
(Carswell & Venkatesh, 2002)	TPB & Diffusion of Innovation theory	Students outcomes of an asynchronous e-learning environment	540 part-time students	A web-based suite of software, utilizing Lotus Notes and Domino	Attitude, social norm, relative advantage, visibility and compatibility are influential factors of e-learning environment outcomes in terms of acceptance and learning

(Alavi et al., 1997)		Impacts of IT-enabled learning on students, faculty and cost	46 students	Videoconferencing and GSS technology	Distance learning environment doesn't make difference on students' performance but experience. Students positively evaluate their learning experience in a virtual e-learning environment
(Chiu et al., 2006)	Expectancy-value model of achievement motivation & Fairness theory	Continuance intention in e-learning environment	221 students	Unix-based e-learning system	Utility value and satisfaction make significant contributions to e-learning use intention. Satisfaction mediated effects of students' subjective task value towards e-learning on behavioral intention.
(Volery & Lord, 2000)		Success factors in online delivery	47 students	Web-based educational environment	Technology (ease of access and navigation, interface design and level of interaction); the instructor (attitudes towards students, instructor technical competence and classroom interaction); and the previous use of the technology from a student's perspective are influential factors on the success
(Webster & Hackley, 1997)		Influences on technology-mediated distance learning outcomes.	247 students	Videoconferencing system	The greater the number of locations, the greater the process loses Students at remote sites did not act as involved in the course Most important influence on involvement and participation was teaching style
(Wang, 2003)		Measurement of e-learning satisfaction with asynchronous systems	116 employees	e-learning systems	A 17-item instrument of e-learning satisfaction
(Selim, 2003)		Students' acceptance behaviors on course websites	403 undergraduates	Course websites	Perceived ease of use and perceive usefulness are two key determinates of the acceptance and usage of course website as an effective and efficient learning tool.
(Toral et al., 2006)		Students' acceptance behaviors on web-based	142 students	Web-based educational tool	External factors including application specific self-efficacy, enjoyment,

		learning environment			playfulness and curiosity, and TAM with significant influence in the use of the tool
(Ngai et al., 2007)		Acceptance behavior on WebCT	836 students	Web-based learning system	PEU and PU are the dominant factors affecting the attitude of student and also significantly mediate the effect of technical support on the attitude and system usage
(Ong et al., 2004)		Acceptance behavior on Asynchronous e-learning system	140 employees in high-tech companies	Asynchronous e-learning system	An extended TAM incorporating perceived credibility and computer self-efficacy explained 44% variance of engineers' BI to accept the e-learning system.
(Pituch & Lee, 2006)		Acceptance behavior on e-learning system	259 students	E-learning system	System characteristics are important determinants to influence use intention. Students who want to use the system as a supplemental learning tool also want to use it as an entire distance learning tool
(Raaij & Schepers, 2006)		The acceptance and use of a virtual learning environment	45 Chinese MBA	Virtual learning environment http://casslearn.city.ac.uk	Social norms and PEU do not influence USE directly but through the significant relationship between PU and USE. PIIT and Anxiety have significant impact on PEU.
(Saadé & Bahli, 2005)			102 business students	Internet-based learning system	CA significantly relates to PU but less important to PEU; PU has strong relationship with IU but not PEU; CA seemed to explain the intention directly and indirectly
(Lee et al., 2005)			347 female; 197 male	Internet-learning portal	Perceived enjoyment had a substantially moderate effect on attitude and behavioral intention; No significant relationship between PEU and Attitude