THE INFLUENCE OF FLOW ON ONE'S INTENTION TO USE E-LEARNING

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ABSTRACT

E-learning has become very prevalent in both educational and corporate training environments due to its numerous and substantial benefits to the organizations and users. Our study aims to study several antecedent factors influencing one's intention to use e-learning over traditional mode of learning. A conceptual model depicting the relationships was proposed and tested. Eighty undergraduate students were recruited to attend an experiment that required them to go through two sessions of course materials. The two sessions have identical content but different delivery and presentation style. The first one is text-based and is used as the control against which the second one, which is interactive and multimedia-based, is compared. Subjects prefer the interactive and multimedia presentation to the text-based presentation, and interactivity, perceived playfulness, and flow experience are identified to be the important factors affecting people's intention to use e-learning systems. Hence, course designers should incorporate interactive and playful elements into the learning modules so that users are likely to achieve the flow experience. The higher is the flow experience, the more likely is one's intention to use an e-learning system.

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CHAPTER I

INTRODUCTION

Definition of E-learning

Generally speaking, e-learning is the delivery of content via all electronic media, including the Internet, intranets, extranets, satellite broadcast, audio/video tape, and interactive TV. According to Elliott Masie, a well-known industry expert, e-learning is the use of technology to design, deliver, select, administer, support, and extend learning[1]. Additionally, Marc Rosenerg (2001) defines e-learning as the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. There are three fundamental criteria of e-learning. First, e-learning is networked, which makes it capable of instant updating, storage/retrieval, distribution and sharing of instruction or information. Second, e-learning is delivered to the end-user via a computer using Internet technologies, such as the TCP/IP Protocol and Web browsers that create a universal delivery platform. Finally, e-learning focuses on the broadest view of learning. Such learning solutions go beyond the traditional paradigms of training. E-learning is not limited to the delivery of instruction, characterized by computer-based training (CBT). E-learning

[1] http://www.learnframe.com

goes beyond training to include the delivery of information and tools that improve performance.

Traditional Classroom Learning vs. E-learning

Features	Traditional Classroom Learning	E-learning
Physical setting	• Classroom with limited scale • Time and location dependent	• Unlimited scale • Anytime and anyplace
Role of instructor	• Active • Instructor-led learning	• Interactive (e-coaches, e-mentors) • Student-led learning
Role of learner	• Passive	• Active with participation and involvement
Content delivery	• Content is delivered in a classroom • PowerPoint slides, textbooks, video and collaboration (mainly Text-based) • The user is being influenced	• E-learning is delivered over the Internet • Simple text, audio, animation, video, simulation, printed and online resources, online communities and collaboration (Interactive and multimedia) • The user is an influencer

In short, **interactivity** and **multimedia** are the features that are most diametrically different from those of traditional classroom learning and e-learning.

Significance of Interactivity and Multimedia in E-learning

Applying the concept of interactivity in e-learning context, it implies that learners can choose and determine the information they receive. Interactive e-learning should compose of interactive and engaging media, ways to connect to mentors, tutors and coaches, search and menuing capabilities similar to "information

reference" Web sites, human collaboration, self-paced modules which offer hands-on practice and a personal learning paths, and finally reference materials such as search, menus, links and shortcuts[2]. Genuine interactive courses which allows "learning by doing" arouse interest and generate motivation to provide a more engaging experience for the learner (Lewin 1951, Brookfield 1986).

Through engaging instructor interaction, top-quality graphics, animations, and hands-on practice labs, e-learning facilitates learners to work through real-world processes and problems. The materials are presented in a way that learners are encouraged to click the mouse to participate and truly interact with the content. Rather than feeling alienated, learners receive more personalized attention from virtual classrooms through the access to dynamic instructor teams who strive to be thorough and entertaining in their delivery format. Experienced mentors are also on-hand to provide one-on-one support by answering learners' questions in real-time without disrupting the flow of the class. The mentors are also available to chat and provide support in between classes. As a result, interactivity results in deeper learning (Kolb 1984).

By using engaging multimedia, e-learning provides learners with animated visual learning scenarios that help explain complex concepts in a manner that sustains learners' attention and helps them retain information more successfully.

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[2] Carman, Jared. Next-Generation e-Learning: Integrated Collaboration, Interactive and Reference Technologies

Cultural Difference in Learning Styles and Habits

A number of researches were carried out to study how different cultural backgrounds of learners affect their perception on e-learning. Chin, Chang, and Bauer (2000) find that Web-based learning is popular amongst students, regardless of their cultural background. Regarding perceptions of Web-based learning, more Asian students are attracted to Web-based learning because it is an innovative idea for facilitating learning. While 80% of the Asian students agreed or strongly agreed to positive feeling about Web-learning, only 53% of the Anglo-Saxon students indicated likewise. In term of access and usage pattern, the Anglo-Saxon group of students (90%) seems more confident in using the Web-based materials. Also, the number of on-line access shows a much higher percentage to the Anglo-Saxon group. Conversely, Asian students recorded fewer accesses to the Web-based materials (75%). The above finding supports Hofstede's (1986) views that Anglo-Saxon students are more accustomed to student-centered situations whereas Asian students prefer a teacher-centered approach.

The research also shows that both groups of students are satisfied with e-mail communication, on-line discussions, and discussions on bulletin boards. It further supports that whilst Asian students are generally more reluctant to speak up in a classroom environment (Hofstede, 1986), they found that communicating on-line is less threatening and they are more willing to participate using virtual learning environment.

Benefits of E-learning

Substantial Cost and Time Saving

One of the biggest benefits of e-learning is substantial cost and time saving. Since e-learning can be accessed from any computer anywhere in the world, it can control delivery costs by cutting travel expenses, reducing the time taken to train people, and eliminating or significantly alleviating the constraints of infrastructure, physical facilities and other administrative costs of planning and implementing a traditional classroom.

Meet Need-driven Demand

E-learning accommodates different learners' learning styles and habits and fosters self-paced learning. Learners in e-learning environment can customize the learning material to meet their own needs. Courses and programs can be created to suit individual's strengths and weaknesses in that learners can exercise tighter control over their learning pace. Learners also have the ability to receive more personalized, one-on-one attention and guidance by directly interacting with the instructor through e-mail, forum, or chat room. E-learning encourages learners to browse information through hyperlinks to sites on the World Wide Web and thereby find information relevant to their personal situation. Hence, it helps improve learning curve. In addition, e-learning encourages learners to take responsibility for their learning and building self-knowledge and self-confidence.

Flexibility and Convenience Enhancement

E-learning provides learners with training flexibility as they can study at their convenience. Learners can access anywhere and anytime as e-learning can be accessed by Web browsing software on any platform such as Windows, Mac, UNIX. Programs and courses can be delivered to any machine over the Internet or intranet. Such a "just-in-time" approach makes learning flexible, accessible, and convenience.

Create Learner-friendly Environment

Learners enrolling an online course enter a risk-free environment in which they can try new things and make mistakes without exposing themselves. This characteristic is particularly valuable in learning soft skills such as leadership. A responsive learning program should keep learners informed of the consequences of their actions and where or why they go wrong. Then, they can go back and re-attempt after a failure. This type of learning experience eliminates the embarrassment of failure in front of a class. It may be especially significant for Chinese learners who are particularly afraid of "losing face".

Increased Retention

E-learning can lead to increased retention and a stronger grasp of the subject. This is because of those various elements, such as video, audio, and interaction, are

combined in e-learning to reinforce the message. Learners are also enabled to revisit or replay sections of the training that might not have been clear after the first play.

Improved Collaboration and Interactivity among Students

E-learning fosters interaction among learners and between instructors and learners. Teaching and communication techniques, which create an interactive online environment, include case studies, simulations, video-streaming, personalized coaching and mentoring, discussion groups, chat rooms, e-mail, bulletin boards and tutorials. E-learning can be more stimulating and can encourage more critical reasoning than traditional classroom learning can because the former allows dynamic interaction in a small group setting. Interaction helps stimulate understanding and recollection of information.

Ease of Information or Materials Update

E-learning materials and information can be updated instantaneously; learners are thus kept abreast of the latest news. Since E-learning is Web-enabled, it permits instructors to update materials across the entire network in real-time. This keeps the content more timely, dependable, fresh, and consistent, which can reduce the risk of misinterpretations.

Limitations of E-learning

Huge Initial Capital Investment

E-Learning can be expensive, especially in the earlier stages of content design and infrastructure setup. Similar to any first-time challenge, learning about new technology takes more resources than expected. The greatest portion of costs associated with e-learning is the start-up costs. Hence, depending on the approach taken, initial costs of developing courses and hidden costs of providing learners support may be considerable.

Technology Dependent

Appropriate hardware and software is a prerequisite for learners to access e-learning. Internet bandwidth may not be robust enough to support the desired level of multimedia. Limited bandwidth leads to slower performance for sound, video, and elaborate graphics, longer waiting time for downloads, and reduced ease of the learning process.

Technology cannot completely replace Human Contact

E-learning is still depended on human support in terms of helping people use the software and supporting learners' learning process. Apart from hardware infrastructure, e-Learning needs to be appropriately supported with human mentors, sometimes refers to 'e-coaches'. Without adequate human support, some e-learners

may experience hardships in grasping the material, absence of feedback, and lack of other learners' support.

Personnel Resistance

E-learning may induce additional burdens on both instructors and learners that usually do not occur in a traditional classroom learning environment. Some learners have phobias in using computers. They may feel e-learning environment is too impersonal, isolated and alone without regular classroom interaction. They may even experience periodic distressing experiences such as frustration, anxiety and confusion, as a result of communication breakdowns or technical difficulties in e-learning.

Not all Courses are delivered well by Computer

E-learning is not appropriate for certain courses like soft skill development trainings that demand more spontaneous response, motivation, social interactions, or face-to-face dialogs. For example, courses like team building, communication, or presentation skills that rely heavily on interpersonal contact are not best served by e-learning but require a more personal contact. Nevertheless, e-learning can be still useful in pre-course preparation or post-course follow-up.

Not all People are suitable for E-learning

E-learning is unsuitable for some types of learners. Compared with traditional classroom learning, e-learning can be seen as relatively cold and impersonal and requires learner to have higher level of self-discipline and self-motivation. Otherwise, learners may easily get procrastinated and delay their course work.

E-learning on the Corporate Level

The Corporate E-learning Market

The future of e-learning among business organizations worldwide is robust. The corporate e-learning market generated nearly $2.3 billion in 2000, and is on track for a growth rate of more than 50 percent, which will allow it to exceed $18 billion in 2005, according to International Data Corp.[3] According to the survey results released by Taylor Nelson Sofres in USA and Canada in 2001, an additional 33% of organizations are planning to implement e-learning within three years[4]. A similar trend is seen from an e-learning industry report from the Online Learning Magazine. More than 40% of the respondents whose employers have not adopted e-learning plan to do so within the next two years[5].

E-learning can be applied to organizational training in various skills areas. In the selection of training topics, organizations often start the implementation of e-

[3] E-Learning Market Expanding Beyond IT Training. November 2001. (http://cyberatlas.internet.com/markets/education/article/0,,5951_914901,00.html)
[4] E-learning in USA & Canada Benchmark Survey. Taylor Nelson Sofres. SkillSoft. 19 April 2001.
[5] Kiser, Kim. State of the Industry 2001. *Online Learning Magazine*. October 2001. (www.onlinelearningmag.com)

learning in IT operation, and technical training. 85% of the respondents in the Taylor Nelson Sofres survey stated that they train employees in this area[6]. It is followed by management and leadership skills at 84% and 77% respectively.

Barriers of Implementation

Despite the wide awareness, many corporations are reluctant or skeptical in using e-learning in their organizations. Among the various reasons, the high initial investment is still the prime barrier to implementation, especially for small to medium enterprises. According to the industry report from the Online Learning Magazine in October 2001[7], 44% of the responded organizations indicated the high cost is the major barrier to use e-learning (Appendix 1). Many corporations are hindered by the large initial investment up-front but fail to see the savings over the long-run. Equally important (43%) is the lack of management commitment that hinders their businesses from adopting such training techniques.

Significance of E-learning on the Corporate Level

Cost Savings to Corporations

Implementing e-learning offers substantial benefits to organizations in reducing costs associated with conventional training. Studies have consistently

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[6] E-learning in USA & Canada Benchmark Survey. Taylor Nelson Sofres. SkillSoft. 19 April 2001.
[7] Kiser, Kim. State of the Industry 2001. *Online Learning Magazine*. October 2001. (www.onlinelearningmag.com)

shown that e-learning can save companies between 15 to 50%[8] of the costs incurred in classroom-based training programs. In some extreme cases, saving can be as high as 50-70% when replacing instructor-led training with electronic content delivery[9]. E-learning trims fixed costs associated with travel, lodging, printing and facilities needed for classroom training. The lost productivity or opportunity cost of taking an employee from day-to-day responsibilities is minimized because the staff can easily re-scheduled his/her learning through e-based courses.

Performance Improvement

It is difficult to objectively measure the improvement in corporate performance as a result of e-learning implementation. Yet, the improvement mainly comes from increased learning effectiveness, information retention, rapid transfer of information, and increased productivity among the employees. Employees have access to the information they need when they need it and a consistent message is communicated to every employee everywhere, anytime. By ensuring the employees always have the right knowledge and tools to work effectively, employee retention can be increased.

Competitive Position

E-learning can be a competitive advantage for corporations. It can help the business remain competitive in its current business environment through several ways. For some fast-moving industries in which constant innovation is the key

[8] Rosenberg, Michael. E-learning Basics: A Guide to the e-learning Industry. *e-learning Magazine.* 29 November 2001. (www.elearningmag.com)
[9] http://www.learnframe.com

competitive edge, new products are introduced many times a year. E-learning can decrease the time-to-market for new products or strategies by speeding up and facilitating the training needed for the staff. Moreover, business processes can be improved when companies within supply chains share information and resources through e-learning or knowledge communities.

E-learning Development In Hong Kong

In the recent years, corporations, tertiary educational institutions, secondary schools, and many Government and semi-Governmental organizations have been under escalating pressure to incorporate e-learning technologies into their training and development curricula. Many organizations have had huge investment in designing and implementation of their e-learning platforms or technologies. Some choose to employ consultancy services from the various Application Service Providers (ASPs) available. Regardless of the type of organization, the nature of learning has been gradually shifted to partially or completely e-enabled mode.

The Hong Kong government has made the use of IT education a priority. For instance, in 2000, the Education and Manpower Bureau has launched a portal, hkedcity.net[10], to promote the use of IT in local education and online learning. Users can join the courses provided by the Education Department for free. Hong Kong Cyber Campus[11] is an Internet campus built by the eight tertiary institutions in Hong Kong. It aims at promoting the use of Internet for teaching and learning, facilitating

[10] http://elearning.hkedcity.net/iLearning/
[11] http://www.hkcampus.net/ecampus-main.phtml

communications and sharing among schools, teachers, and students, and providing high quality educational Internet services and applications to schools.

Semi-governmental organization such as the Hong Kong Productivity Council (HKPC) has been active in promoting and facilitating the adoption of Internet and advance technology in training and development. The New Media Center of HKPC and Business Netvigator of Pacific Century CyberWorks jointly developed hkseminar.com[12] in 2001. This portal, which makes use of data broadcasting and video-streaming technology, offers synchronized seminars, speeches, or presentations for individual participants and companies in staff training.

Many tertiary institutions are leaders in the development and adoption of e-learning in the curricula. WebCT is one of the most widely used platforms of e-learning in Hong Kong's tertiary institutions. It allows students to directly download course materials, lecture slides, and presentations. Discussion forum and upload area are available for students to share their opinions and relevant materials. The IT departments of some tertiary institutions are also engaged in consultancy services for local educational institutions. For example, The Hong Kong University of Science and Technology (HKUST) has a support unit called Center for Enhanced Learning and Teaching (CELT). It maintains a portal called IDEAS[13] (Instructional Development Experiences, Applications and Solutions). One of the divisions of IDEAS, Online Learning and Teaching[14] (OLT), support online learning by providing background information on various forms of online education, commonly-

[12] http://www.hkseminar.com
[13] http://celt.ust.hk/ideas/ideas/index.html
[14] http://celt.ust.hk/ideas/olt/index.html

used instructional strategies, and advices on planning and design of e-learning modules for local schools or HKUST.

Apart from the vast influx of US-based Application Service Providers (ASPs), many smaller ASPs serving the local and the Greater China markets have emerged in recent years. eSchool-world.com[15], Schoolteam.net[16], Edport.com[17], Cyberwisdom.net[18], and EVI Education Asia Ltd.[19] are some of the examples. They provide total e-learning solutions and establish platforms for local educational institutions, Government bodies, and leading corporations.

Many large local corporations are among the early adopters of e-learning in their corporate training. For example, Cathay Pacific Airlines has Online Learning Programme that provides online modules in all areas of general business management[20]. CLP Power Hong Kong Limited has Online Orientation and Induction Program for its 4000 staff. Other companies include Kowloon Canton Railway Corporation, the Kowloon Motor Bus Company Limited, and Sun Hung Kai Properties Limited.

[15] http://www.eschool-world.com/hongkong/index.html
[16] http://www.schoolteam.net/
[17] http://www.edport.com/index.html
[18] http://www.cyberwisdom.net
[19] http://www.evi.com.hk
[20] http://www.cathaypacific.com

CHAPTER II

OBJECTIVES OF THE RESEARCH

The overall objective of the research is to study how the flow experience affects one's intention to use e-learning. Specific objectives include:

1. To gain conceptual understanding of the construct of flow;
2. To study the effect of flow experience on e-learning environment;
3. To examine the relationship between flow experience and intention to use e-learning;
4. To recommend areas of improvement for the e-learning environment.

CHAPTER III

RESEARCH HYPOTHESES

Conceptual Framework: Flow Construct

The flow construct (Csikszentmihalyi 1977) has recently been proposed by Hoffman and Novak (1996) as essential to understanding consumer navigation behavior in online environments such as the World Wide Web. Previous researchers (e.g. Csikszentmihalyi 1990; Ghani, Supnick and Rooney 1991; Trevino and Webster 1992; Webster, Trevino and Ryan 1993) concluded that flow is a useful construct for describing more general human-computer interactions.

In spite of its obvious relevance to computer-mediated environments (CME), the definition of the flow experience is elusive and it is very difficult to come up with a central definition of flow. Appendix 2 summaries the definitions of flow from 16 different studies. Generally speaking, flow is a "holistic sensation where one acts with total involvement and a narrowing of focus of attention."[21]

According to Mihaly Csikszentmihalyi (1977), flow is the "process of optimal experience". Optimal experience occurs when people have experienced

[21] Hoffman, Donna L, Novak, Thomas P and Yung Y.F. (1997), Modeling the Structure of the Flow Experience Among Web Users.

times when, instead of being buffeted by anonymous forces, they feel in control of own actions and become masters of own fate. On the rare occasions that it happens, people feel a sense of exhilaration-a deep sense of enjoyment that is long cherished and that becomes a landmark in memory for what life should be like.

When in the flow state, irrelevant thoughts and perceptions are screened out and people focus entirely on the interaction. The flow experience is characterized by a sense of playfulness; a feeling of being in control; concentration and highly focused attention; mental enjoyment of the activity; a distorted sense of time; and a match between the challenge at hand and one's skills.

Elements that make experiences enjoyable include a challenge requiring skills; a chance of completion; the opportunity to concentrate; merging action and awareness; clear goals; immediate feedback; deep involvement transcending distractions and the awareness of, a sense of control over actions, absorption of self, and expansion of self through experience.

In Hoffman and Novak (1996), flow is defined as "the state occurring during network navigation which is: 1) characterized by a seamless sequence of responses facilitated by machine interactivity, 2) intrinsically enjoyable, 3) accompanied by a loss of self-consciousness, and 4) self-reinforcing. In the flow experience, which formalizes and extends a sense of playfulness, consumers are so acutely involved in the act of network navigation in the Web that nothing else seems to matter. According to Hoffman and Novak, two primary antecedents must be present for people to experience flow while engaged in CME. First, people must perceive a balance between their skills a critical threshold. Second, people must be paying

attention to the interaction, narrowing their focus of awareness such that irrelevant perceptions and thoughts are filtered out.

Research Hypotheses

Our study is revolved around the impact of flow on the intention to use e-learning systems. The different variables are put together and we formulated a conceptual model of intention to use e-learning describing the relationships amongst the variables (Appendix 3).

Direct Influence on Flow

Interactivity is widely studied in many previous researches. Similar to the construct of flow, it is difficult to come up with a single definition. Appendix 4 summarizes the definitions of interactivity from 6 different studies. Hoffman and Novak (1996) distinguished two levels of interactivity: person-interactivity that occurs between humans through a medium and machine-interactivity, which occurs between humans and machines. As stated before, the flow experience in a CME is the state occurred during network navigation, which is characterized by a seamless sequence of responses facilitated by machine interactivity. Therefore, it is logical to put forward the following hypothesis:

H_1: Greater interactivity corresponds to greater flow.

Multimedia is grossly defined as the combination of text, graphics, audio, video, and animation into a single, interactive computer-based environment. Multimedia encompasses everything from the static CD-ROM to fully interactive two-way video. In the past, CD-ROM was the main vehicle for multimedia distribution because it was self-contained and easy to control. However, with the advent of the Internet and transmission technologies such as streaming video and audio, users expect to access this same level of interactivity over remote connections. File distribution and unicasting, including Web browsing, email and FTP; offer users instant access to multimedia content. On the other hand, multicasting can be either a real-time or delayed one-to-many delivery of multimedia content. Similar to interactivity, multimedia plays an active role in enhancing flow. Hence, it is hypothesized that:

H_2: Greater multimedia corresponds to greater flow.

Previous research on human-computer interactions has suggested that computers can encourage playfulness (Webster, Trevino, & Ryan, 1993). The state of playfulness is characterized by the users' perceptions of pleasure and involvement during computer interactions. Csikszentmihalyi stated that flow is an optimal experience characterized by a sense of playfulness. Besides, Hoffman and Novak (1996) suggested that the structure of flow experience closely correlates with playfulness. We further hypothesizes that:

H_3: Greater perceived playfulness corresponds to greater flow.

Direct Influence on Perceived Playfulness

In Dholakia et al. (2000), playfulness referred to the entertainment value of a site. Eighmey (1997) concluded that a successful Web site must combine both entertainment and information to add perceived value to the consumers. It is logical to infer that there is positive correlation between playfulness and interactivity and multimedia. Therefore, we hypothesize:

H_4: Greater interactivity corresponds to greater perceived playfulness.

H_5: Greater multimedia corresponds to greater perceived playfulness.

Direct Influence on Intention to Use E-learning

Hoffman and Novak (1996) suggested that flow experience leads to positive subjective experience from the course and increased exploratory behaviors. We hypothesize positive relationships in the followings:

H_6: Greater flow corresponds to greater intention to use e-learning.

H_7: Greater perceived playfulness corresponds to greater intention to use e-learning.

CHAPTER IV

METHODOLOGY

The Sample

Eighty local undergraduate students at The Chinese University of Hong Kong (CUHK) were recruited to attend the experiment. They are aged between 20 and 24 from all academic faculties in CUHK. Twenty-six of them are male and fifty-four of them are female students. The respondents were randomly assigned into the two groups: Group A received the text-based course first and the multimedia and interactive course later; Group B received the presentations in the reverse order. The contents of the two courses were designed to be identical but were only different in the presentation format. The text-based course was delivered in pure text format without any auxiliary charts, tables, or pictures. The multimedia and interactive course contains added features like sound recordings, hyperlinks, and animated pictures. Independent sample T-tests were done to each question and found no significant difference between the means from Group A and B for most of the questions. The t-values and the p-values are reported in Table 1. In other words, the order of appearance of the two courses did not have any priming effect on the respondents.

Each respondent first read the assigned materials presented in the above-mentioned formats and was then asked to fill in a questionnaire (Appendix 5) to express their attitude towards the text-based learning system and the interactive and multimedia e-learning system.

Definition of Variables

The items used to measure flow, perceived playfulness, interactivity, multimedia, and intention to use e-learning are detailed in Table 2. The reliability of the multi-item scales is measured with Cronbach's alpha. Items that made the scale unreliable were eliminated from the scale. All the scales have Cronbach's alpha greater than 0.7, the minimum required for a reliable scale (Nunnally 1978); and were used for subsequent analyses.

CHAPTER V

RESULTS

Results for Tests for Direct Influence on Flow

In our survey, we found that the effects of interactivity and perceived playfulness on flow are found to be significant at the 5% level (p= 0.013 and 0.000 respectively). Interactivity and perceived playfulness are each positively correlated with flow as shown from the positive regression coefficients (0.281 and 0.530 respectively). In other words, the higher is the level of interactivity and perceived playfulness of the e-learning material, the higher is the level of flow experience. For the relationship between multimedia and flow, we did not find any significant relationship at the 5% level (p=0.485).

The magnitude of the regression coefficients also shows the relative strength of the relationship between the independent and dependent variables. In our case, the magnitude of the regression coefficients is different. For a unit increase in one of the independent variables mentioned above, perceived playfulness will lead to a greater increase in flow than interactivity will as indicated by the corresponding higher regression coefficient.

The variance-inflating factor values for all three independent variables are smaller than 10 (Gujarati 1995), which show that there is minimal multicollinearity between the independent variables.

H_1: Greater interactivity corresponds to greater flow.

H_2: Greater multimedia corresponds to greater flow.

H_3: Greater perceived playfulness corresponds to greater flow.

Regression Coefficients, Standard Errors and p-values (**Dependent Variable = Flow**; alpha = 0.05)						
Hypothesis	Construct	Unstandardized regression coefficient	Standard error	Standardized regression coefficient	p-value	Collinearity Statistics VIF
H1	Interactivity	0.359	0.142	0.281	0.013	1.899
H2	Multimedia	-0.271	0.386	-0.065	0.485	1.310
H3	Perceived Playfulness	0.909	0.174	0.530	0.000	1.584

Adjusted R-square = 0.487
F-value = 26.015; Sig = 0.000 (Predicators are interactivity, multimedia, and perceived playfulness)

Results for Tests for Direct Influence on Perceived Playfulness

The following table contains the results of the tests for direct influence on perceived playfulness. It was found that the effect of interactivity on perceived playfulness is found to be significant at the 5% level (p=0.000), but that of multimedia is insignificant (p=0.953). Interactivity is positively correlated with perceived playfulness as shown from the positive regression coefficient (0.610). The

higher is the level of interactivity of the e-learning material, the higher is the level of perceived playfulness.

Again, the variance-inflating factor values for the two independent variables are smaller than 10, which show that there is minimal multicollinearity between the independent variables.

H_4: Greater interactivity corresponds to greater perceived playfulness.

H_5: Greater multimedia corresponds to greater perceived playfulness.

Regression Coefficients, Standard Errors and p-values (**Dependent Variable = perceived playfulness**; alpha = 0.05)						
Hypothesis	Construct	Unstandardized regression coefficient	Standard error	Standardized regression coefficient	p-value	Collinearity Statistics VIF
H4	Interactivity	0.454	0.077	0.610	0.000	1.310
H5	Multimedia	-0.0148	0.252	-0.006	0.953	1.310

Adjusted R-square = 0.352
F-value = 22.477; Sig = 0.000 (Predicators are interactivity and multimedia)

Results for Tests for Direct Influence on Intention to use E-learning

The direct effects of flow on intention to use e-learning is found to be significant at the 10% level (p=0.063). Flow is positively correlated with intention to use e-learning as shown from the positive regression coefficients (0.271). Hence, the higher is the level of flow of the e-learning material, the higher is the intention to use e-learning. However, we did not find any significant relationship between perceived playfulness and intention to use e-learning at the 5% or 10% level (p=0.328).

The variance-inflating factor values for the two independent variables are smaller than 10, which show that there is minimal multicollinearity between the independent variables.

H_6: Greater flow corresponds to greater intention to use e-learning.

H_7: Greater perceived playfulness corresponds to greater intention to use e-learning.

Regression Coefficients, Standard Errors and p-values (**Dependent Variable = Intention to Use e-learning**; alpha = 0.1)						
Hypothesis	Construct	Unstandardized regression coefficient	Standard error	Standardized regression coefficient	p-value	Collinearity Statistics VIF
H6	Flow	0.147	0.078	0.271	0.063	1.866
H7	Perceived Playfulness	0.132	0.134	0.142	0.328	1.866

Adjusted R-square = 0.124

F-value = 6.572; Sig = 0.002 (Predicators are flow and perceived playfulness)

CHAPTER VI

DISCUSSIONS & RECOMMENDATIONS

The influence of flow on the intention to use e-learning systems is studied in this research. Many previous researches have proposed that flow is an essential element to understanding people's behavior in CME. Except for those hypotheses regarding multimedia, all of our hypotheses were proven from the results collected. Nevertheless, to a large extent, our model of intention to use e-learning systems can correctly highlight the elements that course designers must consider in their e-learning programs.

The design of the e-learning programs must be playful and interactive because these two elements were shown to have positive contribution to the flow experience. At the same time, interactivity also has its effects on flow mediated through perceived playfulness. Therefore, course designers should pay particular attention to these two antecedent factors when improvising e-learning courses.

Interactivity is seen as part of a system where learners are not passive recipients of information, but are engaged with the material that is responsive to

their actions[22]. According to Guay (1995), there are three types of interactivity: navigational, functional, and adaptive. Navigational interactivity can be enhanced by allowing users to have better control of their pace in studying the materials. Adding features like hyperlinks and table of contents can improve the ease of use of the learning materials. Functional interactivity deals with the interaction between humans and machines. This can be improved by putting in games or tasks that require the user and computer working together. Adaptive interactivity can be enhanced by allowing users to alter or supplement the contents of the course. Customization/personalization is the most important dimension of interactivity in information-related sites (Dholakia et al. 2000). Features like message-posting, note-insertion, and highlighting permit users to tailor the course to their needs. Features like online chat rooms, discussion forums, instant messaging improve collaborative interactivity[23] in which users and instructors collaborate in creating new knowledge or further customize the learning experience to the users' needs. Hence, through improving these four types of interactivities, e-learning courses will become more tailored, user-friendly, engaging, and motivating.

Interactivity can also be viewed as a process-related variable with characteristic communication settings. It is a significant concept in computer-mediated communications because it is seen as the key advantage of the medium (Fortin and Dholakia 2000; Rafaeli and Sudweeks 1997; Williams, Rice and Rogers 1988). Some researchers believe that the Web's interactive nature, i.e. the ability of the user to receive and transmit messages creates a totally new communication

[22] Thomas, Ruth (2001). Interactivity & Simulations in e-Learning
[23] Mabrito, Mark. Facilitating interactivity in an online business writing course, Business Communication Quarterly

environment. Instead of the traditional model of one-to-many communication, the Web is a "many-to-many" channel of communication (Hoffman and Novak 1996; Rust and Oliver 1994; Venkatesh, Dholakia and Dholakia 1996).

Moreover, according to Webster et al. (1993), computer technologies can give the user a sense of being in control by providing feedback and explicit choices (e.g., menu). The user may interact or "play" with the computer for the enjoyment of the interactions rather than for utilitarian purposes. The studies further suggest that optimal flow may be positively correlated with the user's increased amount of experimentation and voluntary computer interaction. It also correlates with the user's perceived flexibility and modifiability of the software.

In the e-learning context, interactive learning experience can bring learners to enter a state of intense concentration, high performance, controlled excitement, and the flow experience, which brings feelings of pleasure, power, and accomplishment.

From the inception, we proposed that the introduction of not only interactivity but also multimedia into learning materials could make learning experiences more enjoyable, funny, and engaging. From our empirical result, we have not proven our hypothesis that the higher is the level of multimedia of the course, the higher are the levels of flow and perceived playfulness. There are several possible explanations. First, unlike in entertainment surfing on the web, people in e-learning environment may think that too many multimedia features in a course can potentially distract their attention and immersion in the course, which in

turn disrupts the flow experience. Another possible explanation is culture issue. Although previous researches (Chin, Chang, and Bauer, 2000) showed that web-based learning is popular amongst students, regardless of their cultural background, Asian students are possibly used to learning in formal classroom environment. Too many multimedia elements may not able to get them in the flow state. Again, the insignificant relationship between multimedia and perceived playfulness may be attributed to people's increasing exposure to multimedia-related software, such as Real Player and video streaming. Thanks to the prevalence of IT applications in education, students have ample opportunities in using the Internet. Those multimedia features may not be perceived as exciting and playful as expected.

The higher is the perceived playfulness of the learning module, the higher are the flow and intention to use. Therefore, course designers may include features such as humorous animations or interactive games with the intent to provoke an emotional or behavioral response from the viewer. Playfulness also includes a visitor's interactions with a web site (machine-interaction) as well as multi-person games (person-interaction). Atkinson and Kyadd (1997) found that playfulness is significantly associated with total Web use. Eighmey (1997) found that Web users are assisted by information placed in an enjoyable context. Webster et al. (1993) pointed out that playfulness in human-computer interactions can have both positive and negative consequences. For example, people who interact with computer more playfully may have more satisfactory experiences with computers. This kind of experience is likely to result in significant learning. However, playfulness may also result in nonproductive computer interactions, such as longer time for task completion, or over-involvement with the task. Thus, course developers should

caution that playfulness should not be encouraged in all situations due to its potential negative effects.

From our research results, we found that intention to use e-learning is positively correlated with flow experience. The state of optimal flow is a desirable condition for learning (Csikszentmihalyi 1990). We believe it is because it can lead to increased learning, increased exploratory and participatory behaviors, a perceived sense of control over their interactions in the CME, and positive subjective experiences.

Playfulness (Webster and Martocchio 1992) and flow (Webster, Trevino and Ryan 1993) have been found to relate to increased learning. Wesbter, et al. (1993) suggested that since people develop and apply their abilities through exploratory behaviors that characterize flow interactions, learning is a reasonable outcome of the flow state.

Websters, et.al. (1993) showed that flow is correlated positively with software flexibility and modifiability, and experimentation. Since flow is also positively correlated with expectations of future computer interactions and the actual use of technology, CME facilitates flow and likely leads to the rewards of increased repeat visits and longer times at each visit. This increased exploratory behavior will make users more likely to use e-learning than other learning means.

Because the hypermedia CME is an interactive environment, it affords the foundation for user control that is impossible in traditional, passive media. Control

comes from both the consumer's perception of their ability to adjust the CME by taking the form of network navigation, along with their perception of how the CME responds to their input. Therefore, flow increases perceived behavioral control and hence attracts users to e-learning away from traditional, text-based mode of learning.

As mentioned, optimal flow experience is likely to happen when one is able to concentrate on a task. The state of concentration can be enhanced by the perception of clear goals and immediate feedback provided by the task. The state of optimal flow also requires a match between skills and challenges. In other words, "flow can occur when an activity challenges an individual enough to encourage playful, exploratory behaviors, without the activity being beyond the individual's reach" (Webster et al., 1993).

Playfulness of the learning materials also increases users' intention to use e-learning directly. Webster, Trevino and Ryan (1993) noted that research has suggested "high playfulness results in immediate subjective experiences such as positive mood and satisfaction" (Csikszentmihalyi 1977; Levy 1983; McGrath & Kelly 1986; Sandelands, Ashford and Dutton 1983). Previous research on human-computer interactions (Sandelands and Buckner 1989; Starbuck and Webster 1991) showed that a high degree of pleasure and involvement during computer interactions leads to concurrent subjective perceptions of positive effect and satisfaction. A study conducted by Gardner, Dukes and Discenza (1993) showed that the more people use computers, the more is their self-confidence with respect to computers. This in turn causes more favorable attitude toward computers. Thus, the design of a learning

situation should be aimed to capture both the experience of playfulness and flow, which can create positive subjective experiences and hence higher likeliness to use.

To allow users to experience flow, technological infrastructure plays an important role. Bandwidth issues may become a greater technical barrier when more interactive or multimedia elements are added to the learning modules. Limited bandwidth slows down download time. Internet traffic jams are common especially over the public Internet. Long processing time would inevitably affect the ease of learning process and experience of flow. Future advance in technology will undoubtedly help solve this problem.

CHAPTER VII

LIMITATIONS OF THE STUDY

There are several limitations of our research. First, small sample size confined the scope of study. Second, the research may be with bias and unfairness as we only drew samples from The Chinese University of Hong Kong. Since our respondents were all students, the results are far from convincing to draw representative conclusion. In terms of physical environment, we conducted experiment in a computer laboratory on campus where each respondent sat close to each other and in turn potentially led to interruption. Finally, due to time constraints and resources deficiency, we merely focused on testing interactivity between humans and machines rather than on humans and humans.

In the future, it is suggested that larger sample size helps draw representative results. Also, the background and profile of respondents should not be limited to students. Since e-learning is implementing in both educational institutions and public as well as private organizations, so it is reasonable to gauge different groups of people's intentions to e-learning. More research is needed in order to extrapolate the findings into corporate learning environment. Regarding the software design, there is far more room for testing interactivity between humans and humans. For

example, software can be designed to include virtual tutor and on-line chat room to let students freely express their ideas and questions.

CHAPTER VIII

CONCLUSION

The use of online technology in the learning context is evolving and growing at an exponential rate. E-learning offers a number of advantages such as self-pacing, higher retention of content, flexibility, learner's control, improved interactivity, substantial cost saving over traditional classroom learning. However, e-learning has its limitations, namely technological dependence, inability to suit individual's different learning styles, and inability to provide of soft-skills training. On the corporate level, many organizations regard e-learning as a new way of training that can help them control cost and improve employees' productivity. In Hong Kong, educational institutions, corporations, and Government have been incorporating e-learning technology into their trainings and development curricula. The overall objective of the research is to study how the flow experience affects people's intention to use e-learning. In our study, we borrowed the conceptual framework of flow construct from Crikszentmihalyi developed in 1977. According to Crikszentmihalyi, flow is the "process of optimal experience". When people are in the flow state, they experience a strong sense of playfulness, a feeling of being in control, concentration and highly focused attention, mental enjoyment of the activity, a distorted sense of time, and a match between the challenge at hand and one's skills. We then formulated a conceptual model of intention to use e-learning

illustrating the relationships among the variables. We hypothesized that interactivity and multimedia positively affect perceived playfulness and flow while perceived playfulness and flow positively influence people's intention to use e-learning. Also, perceived playfulness exerts impact on flow, which in turn affects people's intention. Our study was conducted at The Chinese University of Hong Kong and eighty undergraduate students from all academic faculties were recruited. Two kinds of learning materials, text-based and interactive with multimedia-based, were provided. To a large extent, the results are aligned with previous researches' findings. According to our empirical results, greater interactivity corresponds to greater perceived playfulness and flow; flow then leads to positive attitude and greater intention to use e-learning. Similarly, perceived playfulness itself has positive relationship with flow, which affects people's intention to use e-learning as well. However, no significant result is found in the relationships amongst multimedia, flow, and perceived playfulness. There are numerous implications found. People's intention to use e-learning is depended on whether they are in the flow state. Flow is affected by several variables like interactivity and perceived playfulness. Hence, the design of the e-learning programs must be playful and interactive so that they make people fall into the flow experience. All in all, the study is an attempt to provide a systematic analysis of the flow construct. It still has its limitations. Further research is needed to test the proposed relationships, especially those among multimedia, perceived playfulness, and flow.

TABLE 1

INDEPENDENT SAMPLE T-TEST OF GROUP A & B

		t-test for Equality of Means				
Question No.		**T**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
1	Equal variances assumed	-1.413	78	.161	-.5000	.3537
	Equal variances not assumed	-1.413	72.831	.162	-.5000	.3537
2	Equal variances assumed	-.146	78	.884	-5.0000E-02	.3413
	Equal variances not assumed	-.146	77.259	.884	-5.0000E-02	.3413
3	Equal variances assumed	.000	78	1.000	.0000	.2974
	Equal variances not assumed	.000	76.965	1.000	.0000	.2974
4	Equal variances assumed	1.478	78	.143	.6250	.4228
	Equal variances not assumed	1.478	77.215	.143	.6250	.4228
5	Equal variances assumed	1.038	78	.302	.4000	.3853
	Equal variances not assumed	1.038	77.898	.302	.4000	.3853
6	Equal variances assumed	.128	78	.898	5.000E-02	.3905
	Equal variances not assumed	.128	77.599	.898	5.000E-02	.3905
7	Equal variances assumed	-.339	78	.736	-.1000	.2953
	Equal variances not assumed	-.339	72.017	.736	-.1000	.2953
8	Equal variances assumed	-.556	78	.580	-.1500	.2697
	Equal variances not assumed	-.556	77.934	.580	-.1500	.2697
9	Equal variances assumed	.600	78	.550	.2500	.4166
	Equal variances not assumed	.600	75.812	.550	.2500	.4166
10	Equal variances assumed	-.401	78	.690	-.1500	.3743
	Equal variances not assumed	-.401	77.868	.690	-.1500	.3743
11	Equal variances assumed	-1.583	78	.118	-.3500	.2212
	Equal variances not assumed	-1.583	77.254	.118	-.3500	.2212
12	Equal variances	-1.361	78	.177	-.3000	.2204

	assumed					
	Equal variances not assumed	-1.361	76.028	.177	-.3000	.2204
13	Equal variances assumed	-2.153	78	.034*	-.4500	.2090
	Equal variances not assumed	-2.153	76.158	.034*	-.4500	.2090
14	Equal variances assumed	1.480	78	.143	.5750	.3884
	Equal variances not assumed	1.480	77.991	.143	.5750	.3884
15	Equal variances assumed	.000	78	1.000	.0000	.2106
	Equal variances not assumed	.000	77.935	1.000	.0000	.2106
16	Equal variances assumed	-.362	78	.718	-7.5000E-02	.2070
	Equal variances not assumed	-.362	74.108	.718	-7.5000E-02	.2070
17	Equal variances assumed	-.089	78	.929	-2.5000E-02	.2813
	Equal variances not assumed	-.089	77.898	.929	-2.5000E-02	.2813
18	Equal variances assumed	.000	78	1.000	.0000	.3446
	Equal variances not assumed	.000	77.918	1.000	.0000	.3446
19	Equal variances assumed	-.519	78	.605	-.1500	.2890
	Equal variances not assumed	-.519	77.861	.605	-.1500	.2890
20	Equal variances assumed	-.257	78	.797	-7.5000E-02	.2913
	Equal variances not assumed	-.257	77.685	.797	-7.5000E-02	.2913
21	Equal variances assumed	.164	78	.870	5.000E-02	.3054
	Equal variances not assumed	.164	77.254	.870	5.000E-02	.3054
22	Equal variances assumed	1.339	78	.184	.3250	.2427
	Equal variances not assumed	1.339	77.424	.184	.3250	.2427
23	Equal variances assumed	.898	78	.372	.3000	.3340
	Equal variances not assumed	.898	77.245	.372	.3000	.3340
24	Equal variances assumed	.384	78	.702	.1250	.3253
	Equal variances not assumed	.384	77.169	.702	.1250	.3253
25	Equal variances assumed	.595	78	.554	.1750	.2943
	Equal variances not assumed	.595	77.997	.554	.1750	.2943
26	Equal variances assumed	2.209	78	.030*	.4500	.2037
	Equal variances	2.209	73.080	.030*	.4500	.2037

	not assumed					
27	Equal variances assumed	1.502	78	.137	.3500	.2331
	Equal variances not assumed	1.502	66.524	.138	.3500	.2331
28	Equal variances assumed	2.119	78	.037*	.4750	.2241
	Equal variances not assumed	2.119	76.853	.037*	.4750	.2241
29	Equal variances assumed	2.506	78	.014*	.5250	.2095
	Equal variances not assumed	2.506	74.987	.014*	.5250	.2095
30	Equal variances assumed	.950	78	.345	.2750	.2894
	Equal variances not assumed	.950	76.406	.345	.2750	.2894
31	Equal variances assumed	.518	78	.606	.1250	.2414
	Equal variances not assumed	.518	78.000	.606	.1250	.2414
32	Equal variances assumed	-1.288	78	.201	-.3250	.2523
	Equal variances not assumed	-1.288	73.786	.202	-.3250	.2523
33	Equal variances assumed	.448	78	.656	1.000E-01	.2233
	Equal variances not assumed	.448	77.539	.656	1.000E-01	.2233
34	Equal variances assumed	-1.215	78	.228	-.2750	.2263
	Equal variances not assumed	-1.215	76.718	.228	-.2750	.2263
35	Equal variances assumed	-2.065	78	.042*	-.4250	.2058
	Equal variances not assumed	-2.065	78.000	.042*	-.4250	.2058
36	Equal variances assumed	-.481	78	.632	-.1500	.3119
	Equal variances not assumed	-.481	77.984	.632	-.1500	.3119
37	Equal variances assumed	-.107	78	.915	-2.5000E-02	.2330
	Equal variances not assumed	-.107	77.742	.915	-2.5000E-02	.2330
38	Equal variances assumed	-1.245	78	.217	-.4750	.3814
	Equal variances not assumed	-1.245	74.796	.217	-.4750	.3814
39	Equal variances assumed	.187	78	.852	5.000E-02	.2669
	Equal variances not assumed	.187	74.071	.852	5.000E-02	.2669
40	Equal variances assumed	-1.219	78	.227	-.4000	.3282
	Equal variances not assumed	-1.219	76.822	.227	-.4000	.3282
41	Equal variances	-1.030	78	.306	-.2250	.2185

	assumed					
	Equal variances not assumed	-1.030	72.887	.307	-.2250	.2185
42	Equal variances assumed	-1.451	78	.151	-.3750	.2584
	Equal variances not assumed	-1.451	76.337	.151	-.3750	.2584
43	Equal variances assumed	-.888	78	.377	-.2000	.2252
	Equal variances not assumed	-.888	76.360	.377	-.2000	.2252
44	Equal variances assumed	-.102	78	.919	-2.5000E-02	.2453
	Equal variances not assumed	-.102	77.967	.919	-2.5000E-02	.2453
45	Equal variances assumed	1.332	78	.187	.3750	.2816
	Equal variances not assumed	1.332	75.988	.187	.3750	.2816
46	Equal variances assumed	.264	78	.793	7.500E-02	.2846
	Equal variances not assumed	.264	75.791	.793	7.500E-02	.2846
47	Equal variances assumed	-.255	78	.799	-5.0000E-02	.1960
	Equal variances not assumed	-.255	75.410	.799	-5.0000E-02	.1960
48	Equal variances assumed	.000	78	1.000	.0000	.1768
	Equal variances not assumed	.000	77.869	1.000	.0000	.1768
49	Equal variances assumed	-.810	78	.420	-.2000	.2468
	Equal variances not assumed	-.810	74.432	.420	-.2000	.2468
50	Equal variances assumed	.569	78	.571	.2000	.3515
	Equal variances not assumed	.569	74.335	.571	.2000	.3515
51	Equal variances assumed	.322	78	.748	.1000	.3101
	Equal variances not assumed	.322	77.248	.748	.1000	.3101
52	Equal variances assumed	-1.763	78	.082	-.5500	.3120
	Equal variances not assumed	-1.763	77.237	.082	-.5500	.3120
53	Equal variances assumed	.640	78	.524	.1750	.2736
	Equal variances not assumed	.640	75.772	.524	.1750	.2736
54	Equal variances assumed	-.929	78	.356	-.2750	.2960
	Equal variances not assumed	-.929	76.222	.356	-.2750	.2960
55	Equal variances assumed	-.838	78	.404	-.2500	.2982
	Equal variances	-.838	74.174	.404	-.2500	.2982

	not assumed					
56	Equal variances assumed	-.412	78	.682	-.1250	.3035
	Equal variances not assumed	-.412	74.341	.682	-.1250	.3035
57	Equal variances assumed	-.798	78	.427	-.2500	.3131
	Equal variances not assumed	-.798	72.287	.427	-.2500	.3131

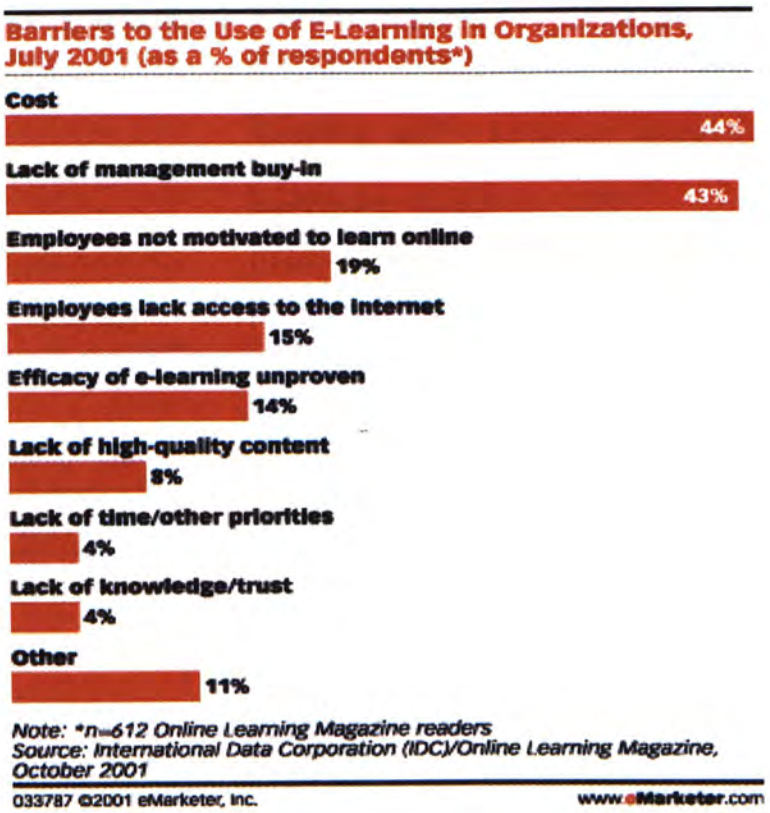
* Significant difference between Group A and B at the level of 5%.

TABLE 2
SCALE DESCRIPTIONS

Scale and its Items	Corrected Item-total correlation	Cronbach's alpha (α)
Flow		**0.8414**
1. Time appears to be going by very quickly.	0.5448	
2. Tendency to lose track of time.	0.2901	
3. Time flies	0.5072	
7. Absorption in what I am doing.	0.4462	
8. Immersion in the task I am performing.	0.4134	
11. Having fun interacting with the site.	0.5326	
12. Providing a lot of enjoyment.	0.5896	
13. Enjoyment in using the site.	0.6244	
15. Ability to excite my curiosity.	0.7053	
16. Ability of the interaction to make me curious.	0.6884	
17. Ability to arouse my imagination.	0.5547	
19. Feeling of having control over my interaction with the site.	0.3569	
20. Feeling of having control over my navigation in the site.	0.4327	
Perceived Playfulness		**0.7516**
30. Being spontaneous (i.e. natural) when using the site.	0.4096	
31. Being imaginative when using the site.	0.5770	
32. Being flexible when using the site.	0.5688	
33. Being creative when using the site.	0.6248	
34. Being playful when using the site.	0.6335	
35. Being like playing a game when using the site.	0.4521	
36. Being original when using the site.	0.351	
37. Being inventive when using the site.	0.4945	
Interactivity		**0.8223**
38. Ability to control the flow of information.	0.4239	
39. Ability to manipulate (eg. zoom and inspect) the images.	0.5343	
40. Ability to change the content.	0.4918	
41. Ability to participate and interact with the site.	0.6146	
42. Mediation (i.e. ability to intervene)	0.6165	
43. Ability to coordinate and collaborate with the site to achieve a goal.	0.6090	
44. Immediate bi-directional feedback.	0.4835	
45. Easy to navigate	0.5988	

46. Ability to do several things at the same time (eg. listening to audio files and reading text at the same time)	0.4916	
Multimedia		**0.7118**
47. Use of multimedia.	0.6051	
48. Use of graphics.	0.6845	
49. Richness of presentation	0.3729	
Intention to Use e-learning		**0.9481**
54. I like the multimedia and interactive site more than the text-based one.	0.8712	
55. I enjoyed the multimedia and interactive site more than the text-based one.	0.8814	
56. I would use the multimedia and interactive site instead of the text-based one if I have a fast connection.	0.8764	
57. I would advise my friends to use the multimedia and interactive site rather than the text-based site if they have a fast connection.	0.8702	

APPENDIX 1



Kiser, Kim. State of the Industry 2001. *Online Learning Magazine*. October 2001. (www.onlinelearningmag.com)

APPENDIX 2

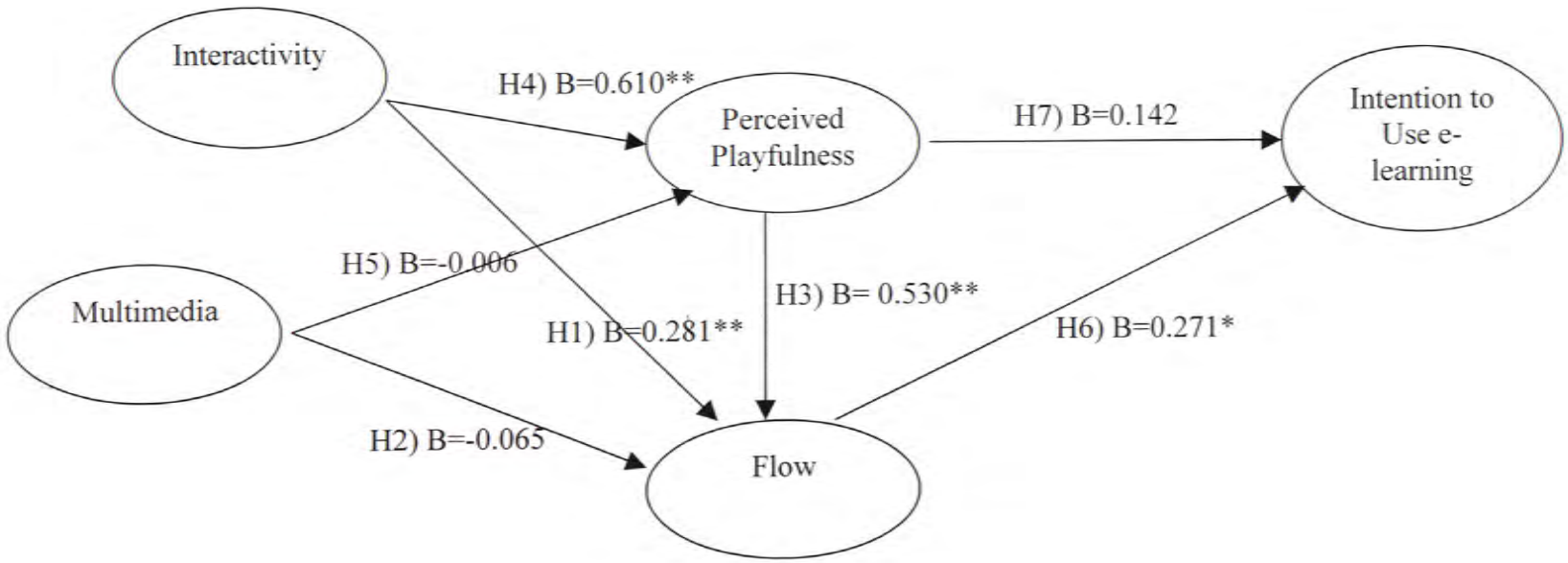
DEFINITIONS OF FLOW

Adopted from: Hoffman, T and D. Novak. Measuring the flow experience among web users. July 1997.

Reference:	Conceptual or Operational Definition:
Csikszentmihalyi (1977)	"the holistic sensation that people feel when they act with total involvement" (p36) when in the flow state "players shift into a common mode of experience when they become absorbed in their activity. This mode is characterized by a narrowing of the focus of awareness, so that irrelevant perceptions and thoughts are filtered out; by loss of self-consciousness; by a responsiveness to clear goals and unambiguous feedback; and by a sense of control over the environment...it is this common flow experience that people adduce as the main reason for performing the activity" (p72)
Privette and Bundrick (1987)	"Flow..., defined as an intrinsically enjoyable experience, is similar to both peak experience and peak performance, as it shares the enjoyment of valuing of peak experience and the behavior of peak performance. Flow per se does not imply optimal joy or performance but may include either or both." (p316)
Csikszentmihalyi & Csikszentmihalyi (1988)	"The flow experience begins only when challenges and skills are above a certain level, and are in balance." (p260)
Mannell, Zuzanek, and Larson (1988)	"Csikszentmihalyi (1975) describes the flow experience as 'one of complete involvement of the actor with his activity' (p36), and he has identified a number of elements that are indicators of its occurrence and intensity. These indicators include: the perception that personal skills and the challenges provided by an activity are imbalance, centering of attention, loss of self-consciousness, unambiguous feedback to a person's actions, feelings of control over actions and environment, and momentary loss of anxiety and constraint, and enjoyment or pleasure." (p291) "Flow was operationalized by measuring the affect, potency, concentration, and the perception of a skill/challenge balance." (p292)
Massimini and Carli (1988)	congruent skills and challenges that are above each subject's average weekly levels
LeFevre (1988)	"a balanced ratio of challenges to skills above average weekly levels" (p307)
Csikszentmihalyi and LeFevre (1989)	"When both challenges and skills are high, the person is not only enjoying the moment, but is also stretching his or her capabilities with the likelihood of learning new skills and increasing self-esteem and personal complexity. This process of optimal experience has been called flow."

Csikszentmihalyi (1990)	we feel "in control of our actions, masters of our own fate...we feel a sense of exhilaration, a deep sense of enjoyment" (p3) "the state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it."
Ghani, Supnick and Rooney (1991)	"two key characteristics of flow: the total concentration in an activity and the enjoyment which one derives from an activity...the precondition for flow is a balance between the challenges perceived in a given situation and skills a person brings to it" (p230) "a related factor is the sense of control over one's environment" (p231)
Trevino and Webster (1992)	" flow characterizes the perceived interaction with CMC technologies as more or less playful and exploratory". Flow theory suggests that involvement in a playful, exploratory experience - the flow state - is self-motivating because it is pleasurable and encourages repetition. Flow is a continuous variable ranging from none to intense." (p540) "Flow represents the extent to which (a) the user perceives a sense of control over the computer interaction, (b) the user perceives that his or her attention is focused on the interaction, (c) the user's curiosity is aroused during the interaction, and (d) the user finds the interaction intrinsically interesting." (p542)
Webster, Trevino and Ryan (1993)	"the flow state is characterized by four dimensions...(a) the user perceives a sense of control over the computer interaction, (b) the user perceives that his or her attention is focused on the interaction, (c) the user's curiosity is aroused during the interaction, and (d) the user finds the interaction intrinsically interesting. (p413)
Clarke and Haworth (1994)	"the subjective experience that accompanies performance in a situation where the challenges are matched by the person's skills. Descriptions of the feeling of 'flow' indicate an experience that is totally satisfying beyond a sense of having fun." (p511)
Ellis, Voelkl and Morris (1994)	"an optimal experience that stems from peoples' perceptions of challenges and skills in given situations. Situations in which challenges and skills are perceived to be equivalent are thought to facilitate the emergence of such indicators of flow as positive affect and high levels of arousal, intrinsic motivation, and perceived freedom" (p337)
Ghani and Deshpande (1994)	"The two key characteristics of flow are (a) total concentration in an activity and (b) the enjoyment which one derives from an activity...There is an optimum level of challenge relative to a certain skill level. ...A second factor affecting the experience of flow is a sense of control over one's environment." (p383)
Lutz and Guiry 1994	"Psychologists use the term 'flow' to describe a state of mind sometimes experienced by people who are deeply involved in some event, object or activity...they are completely and totally immersed in it...Indeed, time may seem to stand still and nothing else seems to

	matter while engaged in the consumption event." [from respondent instructions]
Hoffman and Novak (1996)	"the state occurring during network navigation which is 1) characterized by a seamless sequence of responses facilitated by machine interactivity, 2) intrinsically enjoyable, 3) accompanied by a loss of self-consciousness, and 4) self-reinforcing"



APPENDIX 3 CONCEPTUAL MODEL OF INTENTION TO USE E-LEARNING

* significant at the 10% level

** significant at the 5% level

APPENDIX 4
DEFINITIONS OF INTERACTIVITY

Adopted from: Dholakia, R. et al. Interactivity and revisits to websites: a theoretical framework. 2000.

Authors	Definition
Wiener (1950)	Notion of *feedback*: a method of controlling a system by reinserting into it the results of its past performance.
Steuer (1992)	The extent to which users can modify the form and content of a mediated environment in *real-time*.
Rafaeli and Sudweeks (1997)	The extent to which message in a sequence relate to each other, and especially the extent to which the last message recount the relatedness of earlier message.
Williams, Rice and Rogers (1988)	The degree to which participants in a communication process have control over, and can exchange roles in, their mutual discourse.
Ha and James (1998)	The extent to which the communicator and the audience respond to each other's communication need.
Fortin (1997)	The degree to which a communication system can allow one or more end users to communicate alternatively as senders or receivers with one or many other users or communication devices, either in real time (as in video teleconferencing) or on a store-and-forward basis (as with electronic mail), or to seek and gain access to information on an on-demand basis where the content, timing and sequence of the communication is under control of the end user, as opposed to a broadcast basis.

APPENDIX 5
A SAMPLE OF THE QUESTIONNAIRE

Respondent No._____ (Office use)
****

Please read carefully

Just then you have used two learning sites, one is purely text-based while the other one is interactive and multimedia-based. Now, please compare the two sites and tell me what you think about them. Please note that there are no good or bad, and right or wrong answers. Thank you for your cooperation.

SECTION A

1. How do you feel about the text-based presentation **in comparison with the multimedia and interactive version of the same presentation**? Please circle a number between 1 and 7 where:
   1 = much **worse** than the multimedia and interactive presentation
   7 = much **better** than the multimedia and interactive presentation

1	Time appears to be going by very quickly.	1	2	3	4	5	6	7
2	Tendency to lose track of time.	1	2	3	4	5	6	7
3	Time flies.	1	2	3	4	5	6	7
4	Tendency to spend more time than planned.	1	2	3	4	5	6	7
5	Tendency to spend more time than intended.	1	2	3	4	5	6	7
6	Ability to block out other distractions.	1	2	3	4	5	6	7
7	Absorption in what I am doing.	1	2	3	4	5	6	7
8	Immersion in the task I am performing.	1	2	3	4	5	6	7
9	Getting distractions by other attentions very easily.	1	2	3	4	5	6	7
10	Attention not getting diverted very easily.	1	2	3	4	5	6	7
11	Having fun interacting with the site.	1	2	3	4	5	6	7
12	Providing a lot of enjoyment.	1	2	3	4	5	6	7
13	Enjoyment in using the site.	1	2	3	4	5	6	7
14	Boredom.	1	2	3	4	5	6	7
15	Ability to excite my curiosity.	1	2	3	4	5	6	7
16	Ability of the interaction to make me curious.	1	2	3	4	5	6	7
17	Ability to arouse my imagination.	1	2	3	4	5	6	7
18	Feeling of being in control.	1	2	3	4	5	6	7
19	Feeling of having control over my interaction with the site.	1	2	3	4	5	6	7
20	Feeling of having control over my navigation in the site.	1	2	3	4	5	6	7
21	Allowing me to control my computer interaction.	1	2	3	4	5	6	7
22	Challenging but not too challenging to use.	1	2	3	4	5	6	7
23	Requires concentration but not too complex.	1	2	3	4	5	6	7
24	Intensive but within my capability.	1	2	3	4	5	6	7

25	Requires mental effort but not too demanding.	1	2	3	4	5	6	7
26	Ability to enhance my understanding of MP3 music.	1	2	3	4	5	6	7
27	Ability to enhance my understanding of the copyright issues involved in MP3 music.	1	2	3	4	5	6	7
28	Usefulness of the information about MP3 music.	1	2	3	4	5	6	7
29	Improvement of my understanding of MP3 issues.	1	2	3	4	5	6	7
30	Being spontaneous (that is, natural) when using the site.	1	2	3	4	5	6	7
31	Being imaginative when using the site.	1	2	3	4	5	6	7
32	Being flexible when using the site.	1	2	3	4	5	6	7
33	Being creative when using the site.	1	2	3	4	5	6	7
34	Being playful when using the site.	1	2	3	4	5	6	7
35	Being like playing a game when using the site.	1	2	3	4	5	6	7
36	Being original when using the site.	1	2	3	4	5	6	7
37	Being inventive when using the site.	1	2	3	4	5	6	7
38	Ability to control the flow of information.	1	2	3	4	5	6	7
39	Ability to manipulate (eg. zoom and inspect) the images.	1	2	3	4	5	6	7
40	Ability to change the content.	1	2	3	4	5	6	7
41	Ability to participate and interact with the site.	1	2	3	4	5	6	7
42	Mediation (that is, ability to intervene).	1	2	3	4	5	6	7
43	Ability to coordinate and collaborate with the site to achieve a goal.	1	2	3	4	5	6	7
44	Immediate bidirectional feedback.	1	2	3	4	5	6	7
45	Easy of navigation.	1	2	3	4	5	6	7
46	Ability to do several things at the same time (eg. listening to audio files and reading text at the same time).	1	2	3	4	5	6	7
47	Use of multimedia.	1	2	3	4	5	6	7
48	Use of graphics.	1	2	3	4	5	6	7
49	Richness of presentation.	1	2	3	4	5	6	7
50	Clearness of information.	1	2	3	4	5	6	7
51	Clarity of information.	1	2	3	4	5	6	7
52	Ambiguity of information.	1	2	3	4	5	6	7
53	Easiness to understand.	1	2	3	4	5	6	7

2. Which presentation would you prefer? Please answer the question using a scale from 1 to 7, '**1**' being **strongly disagree** and '**7**' being '**strongly agree**'.

		Strongly Disagree						Strongly Agree
54	I like the multimedia and interactive site more than the text-based one.	1	2	3	4	5	6	7
55	I enjoyed the multimedia and interactive site more than the text-based one.	1	2	3	4	5	6	7
56	I would use the multimedia and interactive site instead of the text-based one if I have a fast connection.	1	2	3	4	5	6	7
57	I would advise my friends to use the multimedia and interactive site rather than the text-based site if they have a fast connection.	1	2	3	4	5	6	7

SECTION B QUIZ

We would like to understand how much you have learned from the demonstrations. Please answer the following questions with brief answers in the space provided based on the information presented. You can refer to the materials in the two learning sites.

1. Who wrote the Napster program? _____
2. Which association first sued Napster? _____
3. Which US Law stated that it is legal to make recordings and lend them out to others, provided it is not done for commercial purposes? _____
4. On which day did the Federal Appeals Court ruled that Napster's users are violating copyright laws whenever they share songs without permission? _____
5. What is the function of Bitbop? _____

SECTION C

Now I have some questions about yourself, just so I can be assured that I have a good cross-section of respondents in my sample. All the information will be kept strictly confidential.

1. Are you: _____ Male _____ Female
2. Your major is: _____
3. What year were you born in? Year: _____
4. Approximate number of years of PC use experience: _____ years
5. Approximate number of years of web use experience: _____ years

----Thank You----

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