CHAPTER II

LITERATURE REVIEW

2.1. Effectiveness

Effective, according to Oxford Advance Learner's Dictionary, means "producing the intended result." The major intended result for electronic documents is as a good medium for transfer of information or knowledge. Therefore, the effectiveness in this research is defined as the easiness and speed in understanding the meaning of or the idea presented in the readings, and the motivation the documents provide to read and continue reading. While there are other ways of defining the effectiveness such as level of understanding and reader satisfaction, they are not considered as the major determinants for the effectiveness in this research.

Measuring the level of understanding will require this research to be carried out in an experimental research setting, which has the limitation of only using a specific kind of electronic document in the experiment, while the goal of this research is to measure the effectiveness of electronics documents in general. Even though the use of various documents can address the limitation in the experiment, the available time and resources simply do not allow for such coverage.

Readers' satisfaction is not considered as a major factor for the effectiveness because the readers' satisfaction of electronic documents is in many ways similar to user satisfaction in information system. While user satisfaction is probably the most studied construct in information system research, reported results have been

inconclusive and many times contradictory. In fact, there is no agreement on even a conceptual definition for user satisfaction and no clearly articulated theory relating user satisfaction to information system success (Woodroof and Burg 1999). In this context, electronic document user satisfaction is also not expected to have high correlation with the success or effectiveness of a knowledge management system, or any other systems in which the electronic documents are utilized.

2.2. Electronic Document

Electronic document is defined as a document presented using an electronic technology. The electronic documents in the context of this research are electronic documents that are presented on screen and do not include electronic media that do not present its content in writing. Electronic media such as interactive movies and audio files are not the objects of this research.

Two most commonly discovered electronic documents in the daily life are hypertext and PDF documents. However, there are other kinds of electronic documents such as wordprocessor and spreadsheet files.

2.2.1. Hypertext Documents

Hypertext documents are documents presented using the Hyper Text Mark-Up Language (HTML) tags or similar technology, such as XHTML. Hypertext documents include Internet websites, web pages on companies' Intranet, and other HTML documents on various electronic media. The hypertext documents are read using web browser applications.

Hypertext documents have some superior characteristics compared to ordinary text. The advantages include the ability to link various parts of the documents for easier navigation, the ability to link to external resources, the ability to perform a quick word search, and the ability to mark previously visited links.

2.2.2. Portable Document Format (PDF) documents

PDF documents are cross-platform documents created using Adobe Acrobat application. A cross-platform document is document that is always readable regardless of the computer system used to read the document. The cross-platform characteristic is made possible by a reader application, called the Acrobat Reader, which is available for all platforms at no cost.

The PDF documents have the abovementioned abilities of hypertext documents plus the ability to maintain its presentation regardless of the computer monitor or printer used for the documents, the ability to zoom in or out, and the ability to authenticate a document (starting from Adobe Acrobat 4.0).

2.2.3. Other Electronic Documents

Other types of electronic documents also exist, such as Microsoft Office documents posted on a company's Intranet, as well as other electronic documents in proprietary formats. Most of them require particular software for reading and editing, and most of the software is not available for free.

Watters and Shepherd (2000) specify another type of electronic documents described as virtual documents. According to them, virtual documents are electronic

documents that are generated dynamically, have no persistent state, and usually generated at run time. A virtual document can be multiple pages, a guided tour, Java applets, or application results, and may or may not have associated links. The content of a virtual document may be defined by tags, a template, a program, a database query, or by some application. The virtual documents were grown out of a need for interactivity and individualization of documents, particularly on the web (Watters and Shepherd 2000).

The virtual documents are a result of shifted people's expectations for access to information. Previously, people accessed information by the retrieval of electronic copies of documents from a large repository of relatively static information. People now expect to access information through the manipulation of a large collection of information resources. Some of these resources are documents and some of these resources are processes that create documents. In addition, the role of user is shifting from reader to active participant and author. Users expect hypertext functionality to be available with digital documents, i.e., users expect to be able to make comments and annotations, to be able to initiate discussion, and to be able to add content and links while reading, both individually and collaboratively (Watters and Shepherd 2000).

A number of interesting research issues must be resolved surrounding these virtual documents on the Web. These issues cover a wide range and are described briefly below (Watters and Shepherd 2000).

• *Generation* - At what point in time is a virtual document defined? A virtual document can be defined by an author through the use of templates and links or

it can be defined as the result of a search or application. Guided tours can be generated dynamically, based on an information need as defined by a user profile and/or an explicitly stated query.

- *Search* - How do you search for virtual documents? What is the domain in which to perform the search? Will the document exist by the time the user requests it?

- *Revisiting* - Users have an expectation that documents found once will be available on a subsequent search. The notion of *bookmark* does not apply to virtual documents in its normal, simplistic way. Bookmarks need enough information to recreate the document as it was.

- *Versioning* - Version control has long been a concern of Information Retrieval research and is now a central issue for management of virtual documents. Users need to be able to return to a bookmarked version of a virtual document and to go forward and backward in time through changes to that virtual document.

- *Authentication* - Who is responsible for the quality of the contents of a virtual document where components may come from a variety of sources and /or processes?

- *Reference* - How do authors cite virtual documents or versions of virtual documents?

- *Annotation* - The roles of user of information and supplier of information are merging. Readers expect to be able to add data, such as, comments, annotations, paths, and links, as well as content, while they are reading.

Watters and Shepherd (2000) also concluded that the web has not only increased the scale of information retrieval systems and applications but has also introduced a new variation of the notion of document. They argue that basic research is required to provide the same level of understanding and measures of effectiveness and efficiency of access to virtual documents as has been achieved for persistent documents.

2.3. Document Processes

The utility of information technology is amplified when its application reaches outside its native domain -- the domain of the computer -- and into the domain of everyday life. Files are the faint reflections in the domain of the computer of documents in the domain of everyday life. While files are created, deleted, renamed, backed up, and archived, people's involvement with documents forms a much thicker fabric: Documents are read, understood, translated, plagiarized, forged, hated, loved and emasculated. The major phases of a document's life cycle are creation, storing, rendering (e.g., printing or other forms of presentation), distribution, acquisition, and retrieving (Halvorsen 2001).

Each of these phases is now supported by digital technology: Word processors and publishing systems facilitate the creation phase, as do multi-media production environments (Halvorsen 2001).

Document (text) databases provide storage for the documents. Rendering is made more efficient through software for the conversion of documents to page description languages (PDLs) and so-called imagers which take PDL representations

to a printable or projectable image. Distribution takes place through fax, networked and on-demand printing, electronic data interchange (EDI) and electronic mail. Acquisition of documents in print form for the purpose of integration into the electronic domain takes place through the use of scanners, image processing software, optical character recognition OCR and document recognition or reconstruction. Access or retrieval is accomplished through document databases (Halvorsen 2001).

2.4. Related Research

The author's efforts to find past researches on the effectiveness of electronic documents had been fruitless. Most researches discovered in the search deal with the broader and more complex problems of e-learning effectiveness. This is, however, viewed as a positive sign that raises the author's hope of giving substantial contribution to the existing body of knowledge. Below, the summaries of some of the research results are presented to give a picture about past attempts to measure effectiveness of e-learning.

2.4.1. E-learning Effectiveness and Impact Measurement

A Cross Functional Task Force has been formed at Cisco to measure effectiveness and impact of e-learning. The purpose of the research is to define the actions required to implement corporate wide evaluation of e-learning offerings consisting of level 1 (learner satisfaction), level 2 (testing for competence), level 3 (on-the-job application), and level 4 (business impact) evaluations. The task force evaluated many aspects about e-learning: satisfaction, penetration and usage,

effectiveness, relevance, and cost. Level 1 evaluation was performed using five-category Likert scale, while level 2 was tested using adaptive testing engine with multiple question type capability. 360-degree and/or multi-user input were used for level 3 evaluation (Cisco 2000, pp 3-15). The research also gives evaluation on benefits of utilizing and implementing e-learning evaluation requirements.

Some method for measurement are suggested to measure effectiveness, which are (Cisco 2000, p 7):

- Pre-test and post-test scores per offering

- Time to completion (i.e., time and visits required to complete individual offering)

- Time to competency as measured by post-test and on-the-job behaviour against course objectives

- Change (+/-) in learner's ability to perform job responsibilities against time spent learning (e.g., increase in sales due to 10 hours of product training) (Cisco 2000, p 7).

The report concludes that to capture, record, and report metrics as part of the e-learning infrastructure, the following mechanisms need to be in place (Cisco 2000, p 14):

- Data needs to be deployed, captured and reported in real time so that both formative and summative evaluation can occur.

- A single mechanism for viewing all reports supported through the infrastructure so that data is easily accessed and used for decision-making processes.

- A "core" set of questions so that common objectives for different delivery mediums can be compared.

- For virtual classes: registrations, virtual student days, cancellations, no shows, and v-class offerings should be captured (Cisco 2000, p 14).

2.4.2. Value Dimension of the E –Learning Concept: Components and Metrics

The research found that:

"The dynamic nature of learning, the different learners preferences, the customized learning content and the establishment of non sequential learning scenarios seem to be crucial obstacles for the majority of e-learning platforms. From this point of view we understand that e-learning is not an effective solution nor either a motivational driver, when we don't capitalize on its value dimension" (Miltiadis, Georgios and Theodora 2001, p 1).

In general, according to the research, there are a number of variables that define the potential performance of an e-learning environment. All these variables can be categorized in six specific components that constitute the product of e-learning: needs, knowledge, motivation, problem solving, team synergy, and packaging. The crucial question in measuring the performance is finding the values that deliver (Miltiadis, Georgios and Theodora 2001, pp 1-2):

- The examination of learners needs,

- The discovery and the construction of the required knowledge,

- The enhancement of motivation on an e-learning environment,

- The ability of learning scenarios to solve specific problems that learners face,

- The establishment of team synergy and collaboration mechanisms and

- The packaging, the right mixes of the relevant components, for the support of any specific learning situation (Miltiadis, Georgios and Theodora 2001, pp 1-2).

    The research work is based on a number of hypotheses or theoretical foundations that jointly formulate their scientific context of analysis (Miltiadis, Georgios and Theodora 2001, pp 5-6), which are:

- Every e-learning system delivers value to the trainers as well as to the teachers. If this hypothesis is true then all the available e-learning tools could be positioned some where on a value grid with different value levels.

- The value delivery of e-learning is based on specific value adding components, which in general constitute a kind of a learning product.

- The realization of the learning product requires the employment of specific learning processes capable to reveal the components of the various e-learning products.

- The value of e-learning is maximized when dynamic characteristics are embedded on e-learning solutions. The definition of these dynamic characteristics is of high priority for our research efforts.

- The value exploitation of e-learning products is directly related to specific metadata capable to support an integrated metadata management mechanism.

- The value dimension of e-learning is related directly to the knowledge management capabilities of the employed e-learning system.

- The value delivery of e-learning systems is related directly to its capability to cooperate effectively with the critical business information systems within an organization (Miltiadis, Georgios and Theodora 2001, pp 5-6).

The paper concludes that poor learning satisfaction, unclear learning methodologies and indisposition of learners to use e-learning were only a few undesirable results of e-learning implementation. It also proposes methodology that can be followed in order to develop full functional e-learning solutions. However, the paper does not provide hints on the research method (Miltiadis, Georgios and Theodora 2001, pp 1-11).

2.4.3. Expanding E-learning Effectiveness. The Shift from Content Orientation to Knowledge Management Utilization.

The research presents some questions, including: "Does e-learning differentiates from the traditional learning?" (Miltiadis and Pouloudi 2001, p 1).

It found that that the majority of e-learning initiatives are limited on the application or the customization of learning platforms that facilitate the delivery of learning content on a predefined, static and sequential way. The flexibility of such implementations is rather inadequate to support the dynamic nature of learning, but as it is the easiest form of doing e-learning it is also the common one. The incorporation of knowledge management mechanisms in learning platforms such as learning objects databases supports the effective management of learning content in terms of reusability and utilization of knowledge bases. This functional enhancement of e-

learning environments is not enough to utilize the learners' perception for e-learning usefulness. The paper suggests that the e-learning effectiveness depends on the implementation (Miltiadis and Pouloudi 2001, pp 1-2).

The data collection in this research is performed by surveying students after they participate in e-commerce seminar using a pilot e-learning system hosted on the WebCT server at the Teletraining Center of Athens University of Economics and Business (Miltiadis and Pouloudi 2001, p 4).

2.4.4. The Case for Level 3

The research found that some organizations report that e-learners consistently finish what they start, but completion results reflect the low priority that some organizations attach to this. Learning results, however, are very positive. Following are results from the study's participating organizations, indicating the effect e-learning has had on competition rates and achievement of learning objectives (Hall and LeCavalier 2001).

- Develop an ongoing feedback loop

- Make the workforce e-learning compatible

- Share best practices

- Develop a custom curriculum

- Eliminate teach-speak

- Consider merging with the knowledge management group (Berry 2002).

The research was carried out using case studies (Berry 2002).

2.4.6. Two Instruments For Evaluating The Effectiveness Of Electronic Education Systems

The research was performed for the Australian Education Council. The goal of the research is to develop a means by which electronic education system effectiveness can be evaluated prior to its purchase. Two such instruments are presented on the report: a Potential Effectiveness Inventory (PEI) and an Instrument for Evaluating Effectiveness of Equipment Used in an Open Learning Context. In combination, these two instruments afford comprehensive information on the effectiveness of electronic systems from the perspective of both educational providers and users (Open Learning Technology Corporation Limited 1997).

The PEI is rated using five critical dimensions, which are (Open Learning Technology Corporation Limited 1997):

- time and place independence
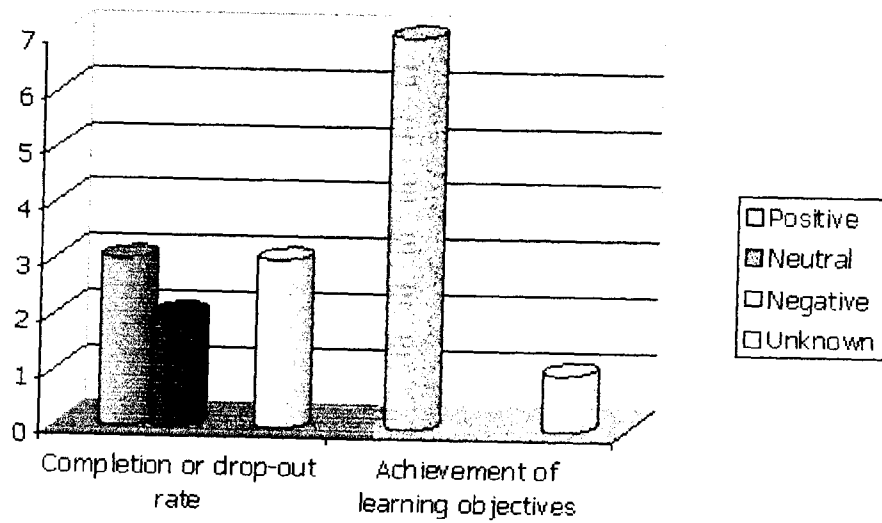
- realism

- communication path

Figure 2.1: Source: Hall and LeCavalier 2001.

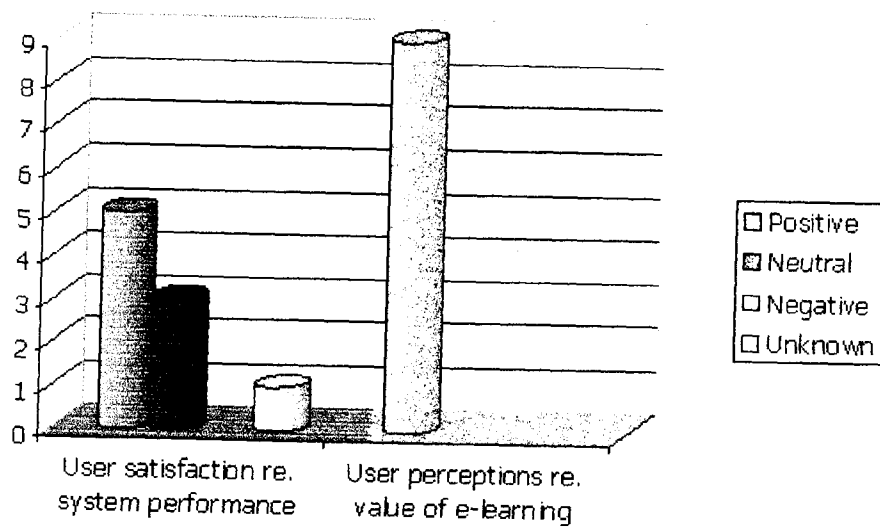Besides, the report also shows results on user perception regarding e-learning:

Figure 2.2: Source: Hall and LeCavalier 2001.

The report concludes that there is little consensus on metrics and measurement methods. However, when data is available, organizations are reporting generally positive results, though user satisfaction has been compromised in some cases by unreliable technology. The business case remains strong, and executive confidence in the effectiveness of e-learning is high in virtually all participating organizations (Hall and LeCavalier 2001).

The research is performed using case study method on 11 US and foreign companies with significant e-learning success stories (Hall and LeCavalier 2001).

2.4.5. The E-Learning Factor

The e-learning definition in the research is "...education and training delivered to the desktop live by an instructor, or self-paced from a curriculum database stored on the enterprise LAN or via an ASP" (Berry 2002). The report cites Gartner Group identification of four main reasons why companies opt for e-learning, as well as the metrics used to define a program's success: enterprise transformation, acquisitions, constant innovation, supply chain (Berry 2002).

It also quotes Gartner Group estimation that about 30 percent of its e-learning clients use metrics to chart e-learning's impact on the company's performance. The research argued that the metrics should be accompanied by common-sense business side to e-learning and provided the following tips as a guide (Berry 2002):

- Build e-learning into the budget and provide discretionary fund pool of at least 20% of the total budget

- Develop an ongoing feedback loop

- Make the workforce e-learning compatible

- Share best practices

- Develop a custom curriculum

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The PEI is rated using five critical dimensions, which are (Open Learning Technology Corporation Limited 1997):

- time and place independence

- realism

- communication path

- ease of use

- speed or immediacy (Open Learning Technology Corporation Limited 1997).

The survey is conducted by inviting each person involved to rate each of the five critical dimensions against each of the others, in relation to the specified electronic delivery technologies. Each value is then given a weight and summed to arrive at the grand total, which becomes the PEI scores for a particular educational technology (Open Learning Technology Corporation Limited 1997).