Building a Critical Components for Successful Multimedia-based Collaborative eLearning Design Framework

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Abstract

With newly developing multimedia and web-based technologies have provided opportunities of developing a multimedia -based collaborative eLearning systems. The development of eLearning systems has started a revolution for instructional content delivering, learning activities and social communication. Based on various positions on this issue have been proposed and a number of theoretical perspectives have been recommended. This study attempts to analyze teaching and learning processes of eLearning instruction as shown in recent literature. Multimedia learning principles, learning models, instructional structure, collaborative environment, pedagogical models, learning metacognition and learner's activities provide the theoretical based for designing and analyzing critical components and develop research model for explaining a Multimedia-based Collaborative eLearning Systems (MCLS).

Keywords
Critical components of eLearning, Collaborative eLearning Systems, Multimedia enhanced eLearning

1. Introduction

The term "eLearning" may have several synonyms such as "distance" "distributed" "flexible" "web-based" or "virtual" learning and these often hides real differences in learning experience, forms of delivery and formal status. eLearning can be thought of as any learning that is done utilizing an internet or intranet connection. Since the emergence of eLearning as a means of providing instruction and the fast expansion of interest in these media in the mid 1990's there have been a number of studies investigated their advances in information technology and new developments in learning science provides opportunities to create well-designed, learner-centered, engaging, interactive, affordable, efficient, easily accessible, flexible, meaningful distributed and facilitated eLearning environments (Khan, 2005).

While the internet and web-based technologies, the problems of providing instruction via these technologies, ie, eLearning, are not totally new nor is instruction via these media necessarily pedagogically innovative. Pedagogical features for teaching and learning can be understood from the perspectives of already existing theories such as the above. eLearning can also be analyzed in the context of multimedia-based instruction, incorporating simultaneous presentation of narration, images and text, and thus provide a teaching and learning environment in which texts, pictures, video and audio are integrated into one system. But mostly, how and when should educators use these

technologies in the most effective ways to enhance teaching and learning, a method and key components of the eLearning on based multimedia systems that has provided a flexible and open learning environment.

Thus, this study attempts to analyze teaching and learning processes of eLearning as shown in recent literature. The main methodology of the study lies in a critical review of the journal in the field of eLearning and multimedia in order to provide better understanding of the essential components for teaching and learning and developing research model for a multimedia-based collaborative eLearning systems.

2. Grounding assumptions for eLearning

eLearning, like all instructional technology delivery environments, must be rooted in epistemological frameworks to be effective for teaching and learning. The effective design is possible only if the developer has a reflexive awareness of the theoretical basis underlying the design. A review of the different perspectives or views on cognition and knowledge is in order. These perspectives include: the cognitive information processing view, the parallel distributed processing view, and the distributed or situated cognition view (Duffy & Cunningham, 1996).

2.1 Cognitive Information Processing view (CIP)

The Cognitive Information Processing (CIP) perspective, which has roots in behaviorist and cognitivist views on learning. Behaviorists utilize the input output events of a computer system to explain how environmental stimuli become inputs in a learning cycle and behaviors (or responses) become outputs, and cognitivists adding the black box as the intervening and impacting variable between input and output to explain the information processing system of the learner. Implicit in this knowledge acquisition model is the principle that information undergoes a series of transformations in the mind in a serial manner until it can be permanently stored in long-term memory in packets of knowledge that have a fixed structure.

2.2 Parallel distributed processing view (PDP)

In this view, also known as connectionism, long-term memory is perceived as a dynamic structure (or network) that represents knowledge in patterns or connections with multiple pathways instead of fixed schemata such as concept nodes and propositions (Driscoll, 2000; Duffy & Cunningham, 1996). Information processing is understood as a process of activating these patterns, in parallel, to accommodate new information by strengthening the most relevant pattern in the knowledge structure based on the goals of the learner at the time of learning.

2.3 Situated cognition view

The situated cognition view bears some resemblance to the PDP model but has additional characteristics that distinguish it from both PDP and CIP. These include (1) the concept that knowledge extends beyond the individual, and (2) the emphasis on perception (how individuals perceive the situation or the environment) rather than memory. Nardi (1996) explains that situated or distributed cognition is concerned with knowledge representations inside and outside the mind and the transformations these structures go through, suggesting that knowledge representations are dynamic, constantly evolving and changing, and subject to infinite juxtapositions, similar to a rhizome, which are also illustrated in Figure 1.

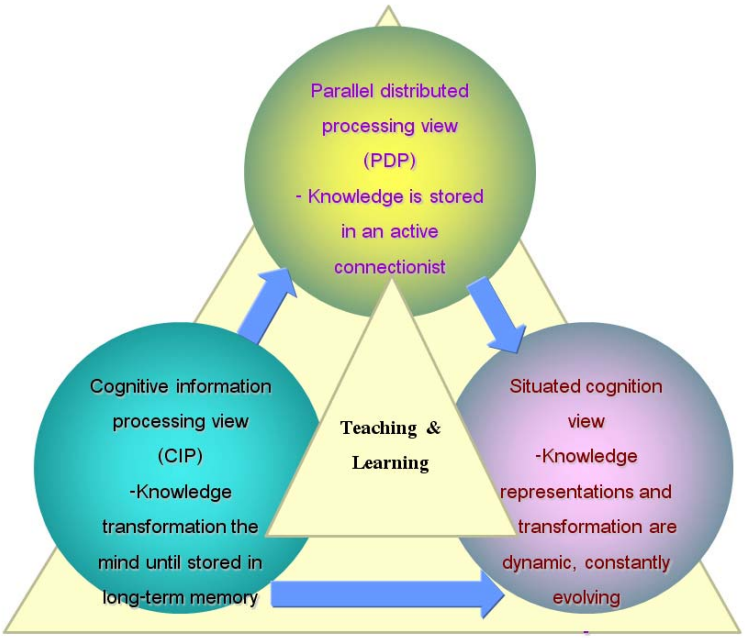

Figure 1: Grounding Assumptions for eLearning Model

3) Cognitive theory of multimedia learning

Mayer proposed a cognitive theory of multimedia learning (Mayer, 2003) established on the basis of three assumptions how people learn from words and pictures: the (1) dual channel assumption, the (2) limited capacity assumption, and the (3) active processing assumption. Within the theoretical framework of the cognitive theory of multimedia learning, active learning occurs when a learner selects, organizes and integrates corresponding verbal and non-verbal information. Figure 2 is a graphical illustration of the steps in this theory.

Dual Channel Assumption: the dual channel assumption is based upon the theory that human cognition consists of two distinct channels for representing and handling knowledge: a visual pictorial channel and an auditory-verbal channel. This theory says that pictures enter through the eyes and are processed as pictorial representations in the visual-pictorial channel. The other channel consists of the auditory-verbal channel or process of spoken words entering the cognitive structure through the ears.

Limited Capacity Assumption: limited capacity assumption is exemplified by auditory-verbal overload, when too many visual materials are presented at one time. Each channel in the human cognitive system has a limited capacity for holding and manipulating knowledge (Baddeley, 1999a, 1999b), so when a lot of spoken words and other sounds are presented at the same time, the auditory-visual channel can become overloaded.

Active Processing Assumption: the third of Mayer's assumptions, active processing, implies that "meaningful learning occurs when learners engage in active processing within the channels, including selecting relevant words and pictures, organizing them into coherent pictorial and verbal models, and integrating them with each other and appropriate prior knowledge" (2002: 60). Important to this assumption is the fact that these "active verbal processes are more likely to occur when corresponding verbal

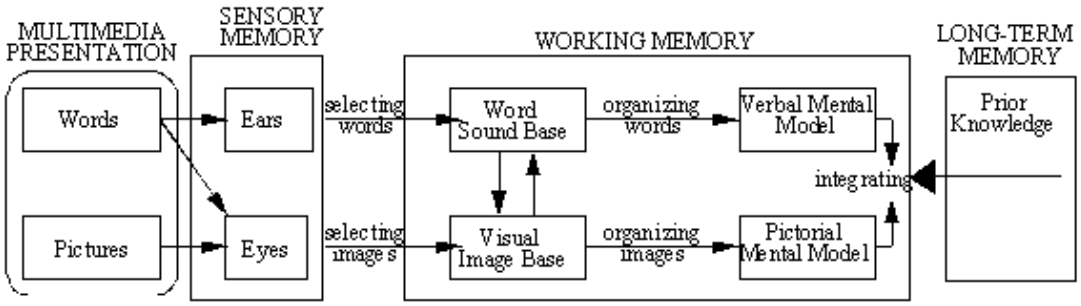

Figure 2: Cognitive Theory of Multimedia Learning

and pictorial representations are in working memory at the same time" (2002: 60).

All of these assumptions are important points and suffer multimedia learning principle to consider in designing and delivery multimedia enhanced eLearning. Mayer's multimedia learning theory offers an indispensable theoretical framework by providing clear information on how to design effective multimedia instruction. Clark and Mayer (2003) have collaborated to condense these principles of multimedia learning, which are more practitioner-based and applicable for this study, Clark and Mayer's eight multimedia principle form the basis for the design of the multimedia instruction. Table 1 include each of these principles and their applications.

Table 1: Cark and Mayer's Eight Multimedia Principles (2003)

Principle	Definition
Multimedia Principle	Students learn better from words and pictures than from words alone. Text or auditory alone are less effective than when the text or narration is augmented with visual images.
Contiguity Principle	Students learn better when corresponding printed words and graphics are placed close to one another on the screen or when spoken words and graphics are presented at the same time.
Coherence Principle	Students learn better when extraneous words, pictures, and sounds are excluded rather than included. Multimedia presentations should focus on clear and concise presentations. Presentations that add extraneous information hamper student learning.
Modality Principle	Students learn better from animation and narration than from animation and on-screen text. Multimedia presentations involving both words and pictures should be created using auditory or spoken words, rather than written text to accompany the pictures.
Redundancy Principle	Students learn better from animation and narration than from animation, narration, and on-screen text. Multimedia presentations involving both words and pictures should present text either in written form, or in auditory form, but not in both.
Personalization Principle	Students learn better when words are presented in conversational style than in expository style.
Interactivity Principle	Students learn better when they can control the presentation rate of multimedia explanations.
Signaling Principle	Students learn better when signals are incorporated into the narration to highlight important ideas or concepts and how they are organized. Signaling emphasizes key words through introductory outlines, headings spoken in a deeper voice, pointer words, and highlighted words spoken in a louder voice.

4.Critical components for successful multimedia-based collaborative eLearning

In addition to above attributes, this definition of eLearning multimedia-based stipulates that there are six key components working collectively to foster instructional content delivering, learning activities and social communication: (1) learning models, (2) instructional structure, (3) collaborative environment, (4) pedagogical models, (5) learning metacognition and (6) learner's activities (Liaw, Huang & Chen, 2007; Liaw & Huang, 2003; Liaw, 2003; Vosniadou, 1996; Zurita & Nussbaun, 2007; Dabbagh, 2005; Park & Hyun, 2006).

4.1 Learning models

Learning autonomy: eLearning seems to provide individualized learning environments that allow learner to exercise autonomy in their learning. Learning to do things, such as developing computer skills, involves the acquisition and refinement of complex motor skills which become faster, more accurate, and more automatic with the accumulation of experience and expertise. Learner being autonomous individuals who construct their own knowledge (Laffey et al., 1998; Bullen, 1998; Jonassen et al., 1999) and being autonomous individuals who are actively involved in their learning (Shneiderman et al., 1998; Hillman, 1999).

Learner collaboration: in addition to autonomous learning, another aspect of eLearning that has appeared in the literature is collaborative learning. Learners in eLearning learn collaboratively as well as individually. Learners especially appreciated having a discussion forum as an avenue for communication when they were having their teaching practice at schools. And interaction among learners is fostered as communication via the web-based technology is simple and convenient when addressing to multiple users.

Teachers as assisted tutors: in essence, The major functions of the teacher are: informing the learner of the objectives, presenting stimuli, increasing learner attention, helping the learn recall what learner has previously learned, providing conditions that will evoke performance, determining sequence of learning activities, and prompting/guiding the learning proves (Joyce & Weil, 1996). From these points of view, teachers are assisted tutors for student's learning.

4.2 Instructional structure

Essentially, eLearning offers both multimedia **ill-structured** and **well-structured** instructional information. Based on multimedia learning theory (Mayer, 2003) , two separate systems can work independently or together for verbal and imagery processing. In addition, when information coding in both systems, it is easier to retain than information coded only in a verbal or imagery system. Hence, **multimedia instruction** formats are more helpful for individual learning than text-only formats.

4.3 Collaborative environment

Collaborative environment means students working together to accomplish shared learning goals and to maximize their own and their group members' achievements (Johnson & Johnson, 1999). In general, to achieve learning in collaborative environment the members must encourage each other to ask questions, explain and justify their opinions, articulate their reasoning, and elaborate and reflect upon their knowledge. A successful collaborative environment can be achieved only when the groups are effective and functioning well (Solomon & Globerson, 1989). And the five

factors that make for effective collaborative environment, which can be summarized: **individual responsibility, mutual support, positive interdependence, face-to-face social interaction and formation of small groups** (Adams & Hamm, 1996; Dillenbourg, 1999).

4.4 Pedagogical models

As described in this paper, pedagogical models are cognitive models or theoretical constructs derived from knowledge acquisition models or views about cognition and knowledge, which form the basis for learning theory.

Open learning: open learning or flexible learning is a new approach to describing distance education where the emphasis shifts from delivering a pre-established curriculum to focusing on individual and local needs and requirements, and creating open learning places based on the here and now (Edwards, 1995).

Distributed learning: distributed learning is described as education delivered anytime, anywhere, to multiple location, using one or more technologies or none at all (Jones Knowledge, 2000). When telecommunications media is utilized, distributed learning refers to off-site learning environment where learners complete courses and programs at home or work by communicating with faculty and other students through e-mail, electronic forums, videoconferences, an other forms of computer-mediated communication and internet and web-based technologies.

Learning communities: learning communities are groups of people who support each other in their learning agendas, working together on projects, learning from one another as well as from their environment and engaging in a collective socio-cultural experience where participation is transformed into a new experience or new learning (Rogoff, 1994; Wilson & Ryder, 1998).

Communities of practice: communities of practice are groups of people informally bound together by shared expertise and passion for a joint enterprise (Wenger & Snyder, 2000: 139). The construct has become popular in the business community and in organizations that focus on knowledge as an intellectual capital

Knowledge building communities: knowledge building communities are learning communities in which communication is perceived as transformative through knowledge sharing and generation.

4.5 Learning matacognition

Metacognitive knowledge consists of knowledge of cognition in general as well as awareness and knowledge of one's own cognition (Anderson et al., 2001: 29). It includes identifying strategies to perform tasks, understanding the demands of various tasks, and knowing one's capabilities for accomplishing them. Thus, metacognitive knowledge refers to knowledge about the interplay between individual characteristics, task characteristics and available strategies in a learning situation to improve learner's **problem-solving** capabilities and **thinking skills** (Flavell, 1979).

4.6 Learner's activities

Interaction: in educational setting, these distributed forms of interaction are manifested in learner-instructor, learner-content, and learner-learner interaction (Moore & Kearsley, 1995). These types of interactions are perceived as necessary in enhancing social learning skills

such as communication or group process skills.

Collaborability: refers to "the degree of collaborative activities and behaviors across organizations in terms of resolving conflicts (Kwon & Suh, 2004). It is contrasted with competitive and individualistic behavior. Learners are expected to share their knowledge and skills with others in the group as well as elicit other group members' knowledge and skills.

Accountability: is important for group success, since some members tend to dominate and some to withdraw, unless mechanisms are in place forcing everyone to participate. Individual accountability is established when each group member understands that she/he is required in each cyclic meeting to briefly report what she/he has been working on and what progress has been made (McKinney & Denton, 2005 ; Gillies, 2003).

5. Conclusion

Thus, based on grounding assumptions for eLearning and cognitive theory of multimedia learning foster instructional content delivering, learning activities and social communication. I believes that six key components should be consideration for designing a Multimedia-based Collaborative eLearning System are : (1) learning models constitute learner autonomy, learner collaboration with teachers as assisted tutors, (2) instructional structure should support multimedia content that multimedia instruction, ill-structured and well-structured content, (3) collaborative environment include individual responsibility, mutual support, positive interdependence, face to face social interaction and formation of small groups, (4) pedagogical models should be open learning, distributed learning, learning communities, communities of practice and knowledge building communities, (5) learning metacognition consist problem solving and thinking skills, and (6) learner's activities consist interaction, collaborability and accountability. Figure 3 presents components and develop research model for explaining a Multimedia- based

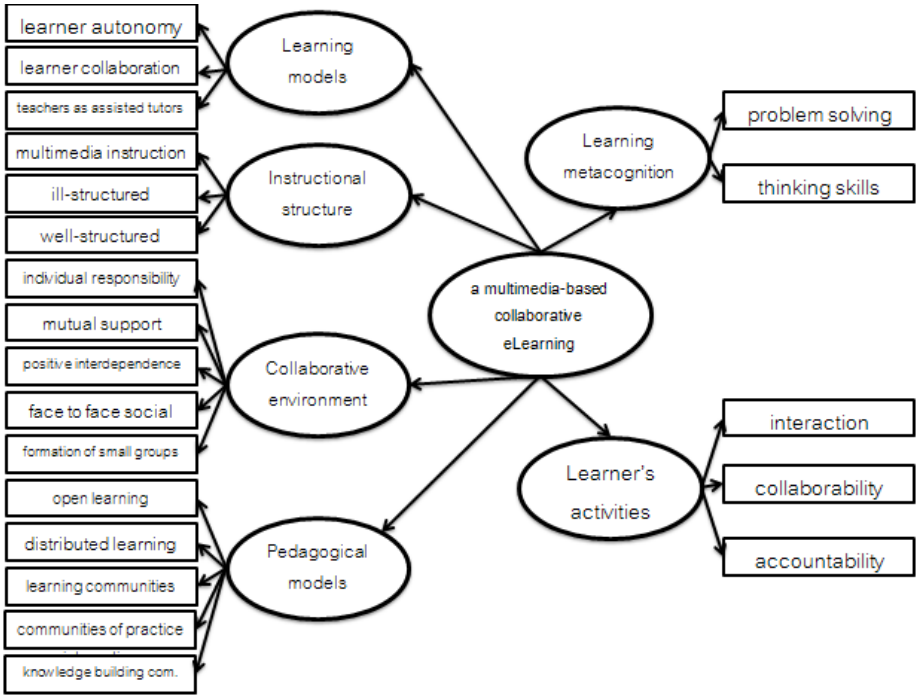

Figure 3: Multimedia-Based Collaborative e-Learning Systems (MCLS) Research Model

Collaborative eLearning Systems (MCLS).

In this study, I try to explore what are the best multimedia pedagogical model and key components for the Collaborative eLearning System based on the related literature. In other words, this (deriving a set of components from various literature sources) is first part of my work. Then conducting an empirical investigation of lecturers' perceived six key component for the Collaborative eLearning System in higher education of Thailand, and practitioners to further explore and evaluate the components that they had developed earlier.

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