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

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ABSTRACT

With newly developing multimedia and web-based technologies have provided opportunities of developing a multimedia-based collaborative e-Learning systems. The development of e-Learning 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 e-Learning 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 e-Learning Systems (MCLS).

Keywords
Critical components of e-Learning, Collaborative e-Learning Systems, Multimedia enhanced e-Learning

1) INTRODUCTION

The term “e-Learning” 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. e-Learning can be thought of as any learning that is done utilizing an internet or intranet connection. Delivery can be asynchronous (allowing learners to go through learning materials at their own pace within broad time constraints) or synchronous (participants attend the on-line learning session at a scheduled time, allowing for live interaction with the instructor and other students) (Haugen & Behling, 2006). Since the emergence of e-Learning 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 e-learning environments (Khan, 2005).

Recent advances in internet and web-based technologies have redefined the boundaries and pedagogies of distance learning by stretching its scope and deepening its interconnectedness (Dabbagh & Bannan-Ritland, 2005). New learning interactions that were not perceived possible before can now be facilitated, such as the coupling of experts from around the world with novices, the instantaneous access to global resources, the opportunity to publish to a world audience, the opportunity to take virtual field
trips, the opportunity to communicate with a diverse audience, and the ability to share and compare information, negotiate meaning and co-construct knowledge. Such activities emphasize learning as a function of interactions with others and with the shared tools of the community prompting (a) the emergence of pedagogical constructs and models such as distributed learning, open/flexible learning, asynchronous learning networks, knowledge building communities, and communities of practice, and (b) the reconceptualization of distance learning as the deliberate organization and coordination of distributed forms of interaction and learning activities to achieve a shared goal.

While the internet and web-based technologies, the problems of providing instruction via these technologies, ie, e-Learning, 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. e-Learning 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 elements of the e-Learning on based multimedia systems that has provided a flexible and open learning environment.

Thus, this study attempts to analyze teaching and learning processes of e-Learning as shown in recent literature. The main methodology of the study lies in a critical review of the journal in the field of e-Learning 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 e-Learning systems.

2) GROUNDING ASSUMPTIONS FOR E-LEARNING

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. Resulting from this view is the specification of instructional and learning strategies that assist the learner in processing information in discrete and linear events that align with internal cognitive processes such as selective attention, encoding, retention, and retrieval. Additional implications for instruction include provision for organized instruction, arrangement of extensive and variable practice, and enhancing learner’s self control of information processing (Driscoll, 2000).

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. Knowledge (or cognition) is thought of as “stretched over” or distributed across the whole network structure of long-term memory (much like a neural network hence the mind as a brain analogy) and not residing in fixed loci in our brains (Salomon, 1993). Therefore, a fundamental distinction between Parallel Distributed Processing (PDP) and CIP is that knowledge is stored in an active connectionist representation versus a static and localized representation, and that information processing occurs in parallel instead of a serial manner, activating knowledge patterns simultaneously and adjusting them as a function of new information to resolve cognitive dissonance. PDP does not attempt to describe cognition at a behavioral level since the knowledge network is an interrelated structure of interactions and not a propositional structure.

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 (how individuals retrieve knowledge). 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 (hence the mind as a rhizome metaphor).

Situated cognition suggests that rather than thinking of cognition as an isolated event that takes place inside one’s head, cognition is looked at as a distributed phenomenon that is more global in nature—one that goes beyond the boundaries of a person to include environment, artifacts, social interactions, and culture (Hutchins & Hollan, 1999; Rogers, 1997). The idea that cognition or intelligence is distributed suggests that learning spaces are becoming more dynamic and complex and that individuals learn from activity and the tools supporting such activity to extend their cognitive potential (Oubenaissa, Giardina, & Bhattacharya, 2002).

3) COGNITIVE THEROY OF MULTI MEDIA LEARNING

Mayer is well-known and respected for his research in the field of cognitive theory as it relates to multimedia learning. His seminal work, Multimedia Learning (Mayer, 2003), is rich with research on how people learn through various multimedia instructional messages. Mayer links cognitive learning theory to multimedia design issues, validating three theory-based assumptions about how people learn from words and pictures: the (1) dual channel assumption, the (2) limited capacity assumption, and the (3) active processing assumption.

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 verbal representations, which includes the 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 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 e-Learning that are multimedia principle, spatial contiguity principle, temporal contiguity principle, coherence principle, modality principle, redundancy principle, individual differences principle, personalization principle, interactivity principle and signaling principle.

4) CRITICAL COMPONENTS FOR SUCCESSFUL A MULTIMEDIA-BASED COLLABORATIVE E-LEARNING

In addition to above attributes, this definition of e-Learning 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

e-Learning 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. In addition, learning to solve educational problems requires the attainment and development of many learning principles and procedures which in turn, make it possible to devise and execute learning activities or solutions (Vosniadou, 1996). Since e-learning provides more flexible learning environments, learners have more autonomy in making decisions regarding their learning. 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).

In addition to autonomous learning, another aspect of e-learning that has appeared in the literature is collaborative learning. Learners in e-learning 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.

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. In general, e-learning systems provide various assisted functions. Such as teacher-made online instruction, online conference, online help and suggestions, online examination, and online monitoring. All these
functions offer opportunities for teachers to be assisted tutors.

4.2) Instructional structure

An instructional structure deserves more attention because an effective one will help learners to create their own knowledge. Essentially, learning processes are influenced not only by the nature of the perceptual stimuli but also by the nature of individuals’ expectation, based on prior knowledge and past experience. Therefore, an appropriate instructional structure can enhance learners’ knowledge construction from their short-term memory to their long-term memory (Atkinson & Shiffrin, 1971).

Essentially, e-Learning offers both multimedia ill-structured and well-structured instructional information. Based on dual-coding theory (Butler & Mautz, 1996), 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 instructional 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).

e-Learning has appeared in the literature is collaborative learning. The effectiveness of collaborative learning over the internet has been confirmed by various studies. It is found that students’ levels of involvement and incentive to learn have increased significantly with a wider and more complete understanding of the subject knowledge (Lee & Chen, 2000; Nagai et al, 2000; Su, Chen & Tsai, 2000). As a result, learners from different background and disperse locations can share their personal and team experience and pool their ideas to solve problems in the learning process.

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). Key principles of open learning are student-centeredness and a focus on learning rather than teaching (The Open University UK, 2002).

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 telecommunication 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). Learning communities represent an intentional restructuring of students’ time, credit and learning experiences around an interdisciplinary theme to foster more explicit intellectual and emotional connections between students, between students and their faculty, and between disciplines (MacGregor, Smith, Tinto & Levine, 1999).

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. Communities of practice are different from formal work groups or project teams in that they are defined by knowledge rather than task, and members are self-selecting rather than assigned by a higher authority (Allee, 2000).

Knowledge building communities: knowledge building communities are learning communities in which communication is perceived as transformative through knowledge sharing and generation. Participants in a knowledge building community share a common goal of building meaningful knowledge representations through activities, projects and discussion and the instructor or tutor is active, learning participant in the community (Selinger & Pearson, 1999: 41).

4.5) Learning metacognition

Metacognitive knowledge consists of knowledge of cognition in general as well as awareness and knowledge of one’s own cognition (Anderson et al., 2001, p. 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

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. They are also perceived as tools or activities that promote higher-order thinking and sustain motivation in distance education setting (Navarro & Shoemaker, 2000).

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. Competition within a group must be discouraged while competition between groups within a larger class is acceptable and often occurs (Lejeune, 2003).

Individual 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 e-Learning 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 e-Learning 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. Fig. 1 presents components and develop research model for explaining a Multimedia-based Collaborative e-Learning Systems (MCLS).

In this study, I try to explore what are the best multimedia pedagogical models and practices are realized for the Collaborative e-Learning 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 e-Learning System in higher education of Thailand, and practitioners to further explore and evaluate the components that they had developed earlier.

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