Chapter 3: Knowledge Management in e-Learning Systems

Knowledge management (KM) and its processes are quite significant in managing substantial information generated in course of eliciting social opinion from multitude of stakeholders dispersed across various strata of the society. This was a motivation to explore the potentials of SECI (Socialization, Externalization, Combination and Internalization), the spiral knowledge construction framework proposed by Nonaka and Takeuchi (1995). This chapter highlights the need to incorporate KM into the process of building socially aware e-learning systems and adapts the SECI model to design a knowledge based framework, Knowledge Management in e-Learning Systems (KMeLS). KMeLS is proposed to accomplish the prime objective of this thesis— to integrate social opinion and adaptivity into the content designing process and study their effects on the knowledge gain of the learners.

3.1 Introduction

Advancements in the realms of technology have led to abundance of information, yet information in any system remains far from meaningful if not channelized and organized according to the system’s requirements. KM refers to the dynamic process of adding value to information already held by an organization, resulting in assimilation of knowledge that is of strategic use to the organization. In short, information needs to be converted into knowledge. Knowledge conversion is facilitated by congregating ideas of stakeholders (or experts) in communities, structuring them and storing knowledge in repositories for future use (Chatti and Jarke, 2007).

The differences between information and knowledge as marked by various researchers (Polanyi, 1966; Polanyi, 1998; Nonaka, 1994; Nonaka, Toyama and Konno, 2000) suggest two things. First, bringing in and assembling of messages result
Adaptive Content Sequencing Incorporating Social Opinion in an e-Learning Environment

in ‘flow of information’ whereas the meaning derived from this information by its respective user (holder) is termed as ‘knowledge’ (Machlup, 1983). Second, knowledge is always dependent upon the context and reflections and experiences of the user (De Long and Fahey, 2000). The contribution of a human mind in the process of knowledge creation is thus, imperative. Over the years, different bases have been sought by researchers to classify knowledge. De Long and Fahey (2000) considered three different types of knowledge: human knowledge, social knowledge and structured knowledge whereas Polanyi (1966) classified knowledge into explicit and tacit knowledge respectively. According to Nonaka (1994), who extended the work of Polanyi (1966), tacit knowledge refers to the intrinsic knowledge possessed by an individual in regard to a concept, but is hard to codify. Though it is the continuous activity of knowing that is reflected in actions, still it could not be put in words easily. Explicit knowledge, on the other hand, is easy to formalize and is transmittable.

Some researchers consider KM as analogous to managing documents, whereas others consider KM as the process of handling unstructured knowledge (Corral, Griffin and Jennex, 2005). Jennex (2005) on the other hand adopted a liberal stand and stresses on a hybrid approach asking for merging technical and organizational perspectives to manage structured and unstructured knowledge so as to improve retention and reuse of knowledge in organizations.

Recently, Saeed et al (2010) have postulated the concept of ‘nomadic knowledge’, a specific type of knowledge that ‘travels’ in due course of its creation. This implies that the knowledge gained during the occurrence of an event resides with the actors involved in the event. As the event concludes, the actors disperse and so does the knowledge. Hence, in situations like these, conversion of nomadic to explicit knowledge becomes all the more vital. This can be achieved by proper documentation of the knowledge processes so that the new actors coming in the scene are able to draw from the experiences of the older ones. Saeed et al (2010) also point out that isolated interactions of users cause formation of localities in the system and varied interpretations crop up for one set of knowledge components. This causes inconsistencies within an organization or a community at large. Information
Technology (IT) comes handy as a solution to this problem.

IT has established itself as a forerunner in constructing frameworks for Knowledge Management Systems (KMS) built over the foundations laid out by grounded epistemological theories and mental modeling techniques like concept mapping and argument mapping. Data capturing techniques like concept mapping combined with data mining tools prove to be quite helpful in eliciting the information and converting it into knowledge (Barker, 2005). Soft computing techniques like data mining combined with neural networks help recognize the hidden patterns within large volumes of data. Analyses of patterns give a clear indication on how to design processes that will work upon the knowledge and convert them into explicit knowledge to be used by the organization. Rule based fuzzy systems are also used to implement well specified processes (Alavi and Leidner, 2001).

The rapid evolution of Web 2.0 has opened new vistas for constructing knowledge collaboratively over the internet. Shirkey (2003) defined social software as the one that supports group interaction. Many software systems exist that lend online social platform to the users to interact with each other both formally and informally, yet there is want of an intelligent KMS that could systematically lead toward the aggregation of individual knowledge into collective knowledge, that is, software supported collaborative problem solving and decision making (Rodriguez et al, 2007; Heylighen, 1999; Turoff et al, 2002).

This chapter highlights the need to involve stakeholders from different strata of the society and incorporate their requirements and suggestions into the process of designing socially aware e-learning content. The potentials of SECI (Socialization, Externalization, Combination and Internalization), the spiral knowledge construction framework proposed by Nonaka and Takeuchi (1995) were explored and adapted to model the e-learning framework as discussed in forthcoming sections.

3.2 SECI: The Knowledge Creation Model

Over the years, KM has evolved as a model with well defined processes: sharing, creation, enhancement, crystallization (Nonaka, 1994), validation, presentation,
distribution, and application (Bhatt, 2001; Holm, 2001; Yeh, Huang and Yeh, 2011). Integrating these processes, Nonaka and Takeuchi (1995) formulated SECI, a four phased spiral model for knowledge construction, comprising Socialization (S), Externalization (E), Combination (C) and Internalization (I) phases. SECI takes on to the spiral process of knowledge creation by transforming one type of knowledge into another in these phases. They also pointed out that the ones on the receiving end not only acquire knowledge but also transform the acquired knowledge by connoting meanings to it within their contexts. Knowledge transformation takes place in four phases namely, socialization, combination, externalization, and internalization (Nonaka, 1994) and is facilitated by congregating ideas of individuals/experts in communities, structuring them and storing knowledge in repositories for future use (Chatti and Jarke, 2007).

Socialization represents tacit to tacit knowledge conversion and involves sharing of ideas by various individuals leading to construction of valuable knowledge mass. Interactions within organizations (both formal and informal) are capable of generating multiple ideas and experiences, yet, tapping these ideas and experiences is a tedious task. Rice and Rice (2005) laid emphasis on the importance of clearing out the inter-organizational barriers that come in the way of socialization processes. Online environment provides dual benefit by not only bringing the user groups together on a common virtual platform but also maintains logs of the online discussion threads.

Externalization represents tacit to explicit knowledge conversion. It creates conceptual knowledge by transforming informal ideas and opinions interspersed in an organization into formal knowledge. Graphical techniques provide support for formalizing tacit knowledge. Thus, inclusion of such techniques in a system benefits the organization by formalizing and conserving its valuable tacit knowledge.

Combination represents explicit to explicit knowledge conversion. It brings order to the existing formal knowledge by clustering it into meaningful structures. Once formalized, the tacit knowledge becomes explicit and hence usable. It can be shared over formal platforms, aggregated and documented using cognitive and digital tools.
Internalization represents explicit to tacit knowledge conversion. It captures the semantics of the knowledge structures and a new kind of tacit knowledge evolves in the process. The connotations extracted from the explicit knowledge accumulated in an organization are comprehended and utilized by another set of users. In due course of time, it becomes tacit knowledge for them. This whole process forms a dynamic spiral of knowledge creation instead of a cyclic sequence of events in knowledge conversion.

The forthcoming section reviews the work of researchers that explored the importance of KM in e-learning.

3.3 Related Work

Infusion of KM into e-Learning has been explored in several studies over the years. Allee (2000) reflects that integration of KM and e-learning in a true sense means to build learning communities that provide a collaborative platform to the learners for acquiring and honing their skills and sharing their expertise in the required domain. Sajja (2008) emphasizes that quality of learning can be improved by adopting knowledge-based approach for e-learning. Most of the studies have highlighted the convergence of KM and e-learning with respect to organizational learning. The goal of KM in an organization is twofold. At community level, the aim of KM is to create conducive environment for encouraging knowledge creation, sharing and use (de Alvarenga Neto and Vieira, 2011), whereas from the individual perspective, the goal is to increase the amount of tacit knowledge possessed by an individual to apply to solving business problems (Woelk and Agarwal, 2002).

A survey conducted by Mercer Management Consulting Study (2001) reflects that innovative enterprises are shifting their focus from mere ‘training’ to wider aspects and affordances of e-learning (Ismail, 2002). Wild, Griggs and Downing (2002) emphasized the benefits of e-learning to business and put forth an e-learning framework integrated into knowledge value chain to mark the potentials of e-learning in becoming an effective tool for constructing and managing knowledge. Wang (2011) also explored the importance of e-learning in workplace. According to Wang
Adaptive Content Sequencing Incorporating Social Opinion in an e-Learning Environment

(2011), workplace learning differs from the institutional learning by being more contextual and dynamic. It arises from the requirements, daily activities and interaction of employees within an organization.

Schmidt (2005) brought in new perspectives to view the juncture where KM and e-learning converge- i) knowledge maturing process, that is, using the metaphor ‘knowledge maturing’ for the process of analyzing the changes in nature of knowledge while being passed on, learnt and taught; ii) employing ‘context-steered’ learning approach into the system; and iii) exploiting the ‘continuity of context’, that is, drawing on the context to overcome the transition between the phases of knowledge maturing process. The problems arise due to constantly changing contexts in which people are working through changing work processes, different tasks or problems to be solved (Ras, Memmel and Weibelzahl, 2005). The solution to the problem of changing contexts lies in addressing the multidimensionality of knowledge by interrelating different knowledge states and their effects on people and their respective performances at work (Nissen and Jennex, 2005). Nissen and Jennex (2005) called for acknowledging the changing contexts and finding out best fits to treat different kinds of knowledge appropriately and differently.

A contextually aware system deduces potential knowledge gaps between the tacit knowledge of the learner and that of the domain by evaluating user interactions. Capturing tacit knowledge should be a natural and non-deliberate process and should be seen as a co-evolution of cognitive and social systems (Kimmerle, Cress and Held, 2010). Web 2.0 social software tools such as social networking, social bookmarking, gaming, topic maps, weblogs, wikis and so forth are effective in capturing the tacit knowledge of employees in an organization and e-learning provides a training and knowledge sharing platform for the organization (Lau and Tsui, 2009; Kane, Robinson-Combre and Berge, 2010).

To bridge up the gaps, the system should recommend appropriate learning content to the learners. Thus the content creation process must respect the needs and constraints of the prospective learners and incorporate their points of view while formulating the curricula. Niculescu, Ionita and Dobrica (2010) introduced the notion
of Knowledge Work Management (KWM). Knowledge work denotes the activities of any worker on a strategic and operational level and KWM aims at creating optimal conditions for efficient, effective and attractive knowledge work. People working in different organizations form a community of knowledge workers and their efforts leverage the collective knowledge of the community as a whole.

Though literature is replete with research in managing organizational learning, it has been seen that there is a positive movement toward building KMS to support higher education by blending e-learning technology into the grounded processes of KM. Barker, van Schaik and Pearson (2003) exhibited an Electronic Performance Support System (EPSS), a computer-based environment with inbuilt ‘Help’ and ‘Advisor’ systems to inculcate skills and enhance knowledge according to a learner’s needs. Marshall et al (2003) presented their system, ‘GetSmart’ that integrates curriculum tools, search tools, and concept mapping technique. The search and curriculum tools access repositories of community knowledge and concept mapping congregates the ideas of individuals to construct knowledge collaboratively. Hong, Zhan and Zhou (2009) presented a KMS based model of e-learning for Chinese universities. The model segregates the input data in terms of structured and unstructured data present in the knowledge database and puts it to use for teaching and learning purposes.

Liaw, Hatala and Huang (2010) extended the notion of e-learning to m-learning or mobile learning and presented an activity theory based m-learning system. Their system used integrated, personalized, shared, and server-based prototypes to facilitate users’ knowledge. Accessing learning content on personal digital assistants or PDAs supports the ‘any time any where’ paradigm and brings out the true essence of e-learning. Several ontological frameworks also have been proposed to integrate KM and e-learning (Lytras and Sicilia, 2005; Sicilia et al, 2006; Abecker and van Elst, 2009; Mikroyannidis, Lefrere and Scott, 2010; Rego et al, 2010).

Silva et al (2010) viewed knowledge construction in light of ethical and cultural perspectives and present a conceptual framework for knowledge authoring in e-learning incorporating ‘ethicultural’ sensitivities. Culture and context affect how one
represents, stores, transfers and applies knowledge (Jennex and Zakharova, 2006). An individual is ethically sensitive if he/she is aware of the effect of his/her actions on the welfare of other individuals or society. Cultural sensitivity makes one aware of the cultural sensibilities around the globe and knowledge systems must care for these contexts and prevent any conflicts with them during knowledge construction processes. Silva et al (2010) also proposed to perform cost benefit ethical analysis to address the ethicultural sensitivity in e-learning.

The next section presents Knowledge Management in e-Learning Systems (KMeLS), the proposed framework modeled to deal with the inter-convertion of tacit and explicit knowledge assets in an e-learning environment. It realizes the inclusion of social opinion into the process of e-learning content designing. It also accomplishes adaptive e-learning by incorporating Adaptive Content Sequencing (ACS) in the content dissemination process.

3.4 KMeLS: The Proposed Framework

Learning in an online environment needs to be seen both as participation in a community of practice and a flow of previously acquired knowledge. Effective content designing for an e-learning course, thus, needs to take into account the background knowledge as well as future expectations of the prospective learners. Research has brought forth the benefits of taking inputs from the learners while designing a course. This also paves way for the students to participate and acquire tacit knowledge in due course. The experiences of passed out students give clear pointers into what must be included in the course and to what extent.

The present study proposes to takes this stand a step beyond by involving society into the process of knowledge creation. The know-how of the expert communities in the society provides an unparalleled technical and practical insight in the methods to be adopted for teaching intricate concepts. To reflect the same, a social opinion based framework, KMeLS, has been modeled on the SECI framework (Sharma, Banati and Bedi, 2012).
In accordance to the SECI framework, KMeLS has four phases (Figure 3.1).

![KMeLS Framework Diagram]

**Figure 3.1** The KMeLS (Knowledge Management in e-Learning Systems) Framework

The point of origin in KMeLS is society, the melting pot of diverse opinions from individuals belonging to different spheres. An organization is a miniature of the society comprising individuals hailing from diverse cultures, philosophies and domains of a society. Most of the organizations are closed spaces and the interaction among the individuals is more or less inevitable. An e-learning organization too is not an exception, although interaction across such an organization may be technology-enabled. Evolution in technology is facilitating better methods of remote communication notwithstanding the physical distances.

The **Socialization** phase in KMeLS supports this idea and honours the importance of disparate views of e-learning stakeholders that surface during interactions. The continuous sharing of tacit knowledge among the stakeholders helps in designing up-to-date and socially relevant e-learning content, which is the inherent motive of the KMeLS framework. This phase also studies the patterns of interaction among learners
and instructors and models plans to disseminate learning content to the learners according to their interaction preferences.

In the *Externalization* phase, the stakeholders from various fields are invited to be a part of the expertise network. Once they agree, they either participate in a synchronous online forum, where they brainstorm over the issues related to content creation for an online course or they post their suggestions and comments in asynchronous mode through email or blogs. The recommendations thus compiled are the source of tacit knowledge and provide insight into the process of content creation. This tacit knowledge on analysis is converted to explicit knowledge in this phase.

In the *Combination* phase, the concepts are sequenced to form course modules, according to their levels of difficulty and prerequisites, once the concepts are finalized in previous phase. Stigmergic Agents are implemented to generate customized learning paths of a course for personalized learning. This leads to the transformation of explicit to explicit knowledge.

In the *Internalization* phase, the course is delivered to the students. The students go through the content, imbibe and implement the concepts and in turn enhance their skills. Their learning experiences and knowledge gained depends upon how well they have comprehended the concepts. Thus, different students reflect in varied degrees over the same content. These varied sets of knowledge patterns form a wealth of tacit knowledge that gets assimilated in the minds of students over the years. The transformation of explicit knowledge into a new tacit knowledge takes place in internalization phase.

The next four chapters respectively elaborate on each of the four phases of the proposed KMeLS framework. The forthcoming chapter takes on Socialization, the first phase of KMeLS. It begins with identification of the stakeholders belonging to an e-learning organization and defining their roles. The chapter also explores the interaction between the learners and instructors, the two main stakeholders of the e-learning system, to find out the comfort zones of the learners so that dissemination of e-content is done in a way that suits the learners.