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Abstract

Abstract: In today's competitive global economy characterized by knowledge acquisition, the concept of knowledge management has become increasingly prevalent in academic and business practices. Knowledge creation is an important factor and remains a source of competitive advantage over knowledge management. Information technology facilitates knowledge management practices by disseminating knowledge and making codified knowledge retrievable. Thus, this paper proposes a framework of knowledge creation in online learning environments. In addition, the features and issues of knowledge creation in these environments are discussed.

Résumé: Dans le cadre de l'économie actuelle, concurrentielle, internationale et caractérisée par l'acquisition de connaissances, le concept de gestion du savoir est de plus en plus répandu tant à l'université que dans les pratiques commerciales. La création du savoir est un facteur important qui donne un avantage concurrentiel sur la gestion du savoir. La technologie de l'information facilite les pratiques de gestion du savoir par la dissémination de la connaissance et l'accessibilité aux connaissances codifiées. Cet article propose ainsi un cadre de création du savoir dans des environnements d'apprentissage en ligne. Nous présentons, de plus, les caractéristiques de la création du savoir et les questions qu'elle soulève dans ces environnements.

Introduction

Data, raw facts, are usually collected as results of observations or measurements from environments. Data processing signifies the capturing, storing and processing data for the purpose of transforming it into information useful for decision-making. Information denotes data that has been processed so that it is meaningful for users. Generally speaking, data refers to collected facts

that are not useful for decision making if there is no further processing. Thus, information is directly useful in making decisions because it has been processed and interpreted. Traditionally, information technology is thought to have the capability of integrating and summarizing detailed data to produce relevant information for management. However, knowledge is more complex and valuable than information, since it lets a learner know how to use the information to solve a problem. As Lopez and Donlon (2001) noted, "knowledge is an organized collection of facts, rules, and heuristics as well as how and when to apply them to solve a problem" (p. 45). In short, knowledge, a competitive resource, is fundamentally different from information and data (Shin, Holden, & Schmidt, 2001).

Table 1.
Technology innovation in data, information and knowledge levels.

Levels	Technology role	Purpose
Data	Collect data	Data processing
Information	Integrate and summarize Information	Information Management (Decision making)
Knowledge	Knowledge discovery creation, and retrieval	Knowledge Management (Problem solving)

From Nonaka and Takeuchi's point of view (1995), knowledge is not only regarded as data or information that can be stored in a computer, it also involves emotions, values, and intuition. To understand the true nature of knowledge, it is necessary to recognize that tacit and explicit knowledge are essential to knowledge creation (Nonaka, Toyama, & Konno, 2000). In knowledge management, there are two kinds of knowledge: explicit and tacit (Nonaka & Takeuchi, 1995; Trentin, 2001). Explicit knowledge can be expressed in words and numbers. Moreover, this kind of knowledge can be distributed as data, scientific formulas, reports, manuals, basic principles, and so on (Trentin, 2001). Explicit knowledge is easy to manage on a computer, communicate via the Internet, and store in a database. On the other hand, tacit knowledge is directly connected with ideas, values, emotions, perceptions and experience. Thus, the subjective and intuitive nature of tacit knowledge makes it difficult to be represented or transferred in a logical and systematic way (Trentin, 2001). In short, explicit knowledge refers to the "knowing about" (the objective knowledge), while tacit knowledge involves the "knowing how" (the subjective knowledge) (Bolisani & Scarso, 1999).

Many researchers have investigated enablers such as people, organizations, processes, and systems for fostering knowledge (Choi & Lee, 2002; Nonaka, Toyama, & Konno, 2000; O'Dell & Grayson, 1998; Teece, 2000). Moreover, knowledge management is supported by technologies that facilitate the capture, manipulation and dissemination of knowledge. In general, knowledge management or knowledge sharing in organizations is based on an understanding of knowledge creation and knowledge transfer (Mclnerney, 2002).

The main purpose of this article is to propose a framework of knowledge creation for online learning, since knowledge creation is a critical competitive advantage in any learning process. As a result, knowledge educators integrate information technology into instructional design. They use

the concepts of knowledge management as well as offer strategies to create and manage knowledge more effectively for online learners to acquire and share it. The framework guides us to understand how to utilize knowledge resources and capabilities as well as how to enhance online learners' abilities on knowledge creation.

Review of Constructivist Theories

Constructivism holds that learners learn actively and construct new knowledge based on their prior knowledge. Prior knowledge is defined as being "dynamic in nature; available before a certain learning task; structured; explicit and tacit in nature; levels of conceptual and metacognitive components." (Portier & Wagemas, 1995, p.66) Moreover, Schwen, Kalman, Hara & Kisling (1998) claim that knowledge is a process that is organic, fluid, and dynamic.

Dewey (1916) considered that the main function of education was to improve the reasoning process and to foster the problem-solving abilities of learners. A learner who is not motivated will not really perceive a problem, so problems selected for learning should be derived from learners' interests. Vygotsky (1978) placed more focus on the social context of learning. His theory emphasized the importance of the sociocultural context in which learning takes place and how the context has an impact on what is learned. Since Vygotsky stressed the critical importance of people's interaction in cognitive development (Maddux, Johnson & Willis, 1997), much of collaborative problem solving strategy is built on the best-known part of Vygotsky's idea - the zone of proximal development (ZPD). Vygotsky (1978) defined ZPD as " the distance between actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Thus, constructivism emphasizes the development of learners' ability in solving their real life problems. As a result, problem solving and free discovery come together. In other words, knowledge is dynamic and is built around the process of discovery (Dewey, 1916).

Creating Knowledge Centers for Educators and Learners

"The primary function of knowledge management is to codify and capture knowledge." (Sorensen & Lundh-Snis, 2001, p. 86) Moreover, the transfer of existing knowledge and creation of new knowledge have become two critical tasks for knowledge management (Krogh & Grand, 2000). In particular, knowledge creation is a continuous process whereby individuals and groups in online communities share tacit and explicit knowledge (Bloodgood & Salisbury, 2001).

Knowledge can be created through conversion between tacit and explicit knowledge by four different modes (Choi, & Lee, 2002; Choo, 1996; Malhotra, 2000; Nonaka & Takeuchi, 1995):

1. Socialization involves social conversion to share experience from tacit knowledge to tacit knowledge. This process attempts to share experience and thereby to create and exchange tacit knowledge. Thus, socialization is used in sharing learners' experience and know-how with other learners.
2. Externalization involves the conversion of tacit knowledge into explicit knowledge. This process attempts to rationalize tacit knowledge and articulate it into explicit concepts and formal models (e.g., to write instruction manuals).
3. Combination converts explicit knowledge into more complex and systematic sets of explicit knowledge. This process involves individuals combining and exchanging different explicit knowledge to explicit knowledge with others. Existing learning information in the databases might be integrated to create new knowledge.
4. Internalization is a process of embodying explicit knowledge into tacit knowledge and internalizing the individual experiences gained through the other models of knowledge creation in the form of shared mental models. Through internalization, explicit knowledge created is shared through an online learning community and converted into tacit knowledge by individuals.

Knowledge management can be associated with opportunities offered by online communication technologies (Bolisani & Scarso, 1999; Earl, 1994; Zack, 1998). The technologies can contribute greatly to the transfer and sharing of valuable knowledge without geographical limits. More specifically, they can transfer data, information and knowledge from a sender to a receiver (Bolisani & Scarso, 1999). Basically, knowledge transfer and creation mainly involve educators and learners in online learning environments. One of the most important roles for educators is to transform their knowledge to learners. Thus, educators (as senders) attempt to transfer and codify explicit and tacit knowledge to learners (as receivers) by building a knowledge creation center. Since the knowledge management theory is still developing, information and technological professions all attempt to examine knowledge management (Mclnerney, 2002). This paper proposes a framework that can guide educators to conduct knowledge practices in online learning environments. For knowledge educators, the most difficult thing is to learn how to transfer tacit knowledge into explicit knowledge for learners' retrieval. In this approach, the processes of combination and externalization are applied to transfer educators' explicit and tacit knowledge into explicit knowledge. On the other hand, online learners can learn individually through internalization or with group interaction provided through social activities in online learning environments.

Educators' Combination Process

In general, educators can transfer their explicit knowledge into a course structure. An online environment provides large-scale databases to facilitate the process of converting explicit knowledge into a more systematic explicit knowledge base. Explicit knowledge can be collected from educators' brains or textbooks. For example, Bruner (1966) suggested that instruction must be presented by well-structured forms to convey knowledge so that learners can understand and gain the knowledge easily. Superior methods for structuring knowledge would result in simplifying, generating new propositions, and increasing the manipulation of information.

Firstly, educators should analyze their online learners' requirements and accurately define their needs and goals. Thus, educators transfer explicit knowledge through their syllabi that clearly define course objectives, prerequisites, the grading scheme and teaching materials (Kearsley & Lynch, 1996). After that, study guides provide extra explanation for studying a course such as information about assignments and discussions. In order to deliver explicit knowledge within an online course, structured knowledge can be converted into data, formula, and text for everyone to understand and capture. An online program offers a structural configuration that meets the purpose of the course and the learners' needs (Kearsley & Lynch, 1996). For example, textbooks can be converted into hypertext mode for online learning environments. Hence, the creative use of information technology can facilitate the explicit knowledge conversion such as syllabuses, study guides and so on.

Educators' Externalization Process

Knowledge practice aims to convert tacit knowledge into explicit knowledge (Sorensen & Lundh-Snis, 2001). The knowledge transfers from tacit into explicit can happen through the creation of documents, mail, reports and memos (Kermally, 2002). When educators' tacit knowledge is made explicit, knowledge is stored in the creation center, thus allowing it to be shared by other learners. The Web presents text and multimedia resources with embedded links that support linear and nonlinear learning. Spiro, Feltovich, Jacobson & Coulson (1995) pointed out that constructivist theory emphasizes the real-world complexity and the ill-structured nature of many knowledge domains. Moreover, ill-structured aspects of knowledge are often presented in advanced knowledge

acquisition. Starr (1997) noted that a Web-based system went beyond static Web pages and page linking as it created truly interactive networks with information exchange between users and servers. As a result, hypertext or hypermedia is an alternative way that allows educators to share their tacit knowledge.

Web technology facilitates knowledge management practices by allowing the rapid dissemination of knowledge, making codified knowledge retrievable and providing access to individuals with specialized knowledge. For example, visual representations help educators to codify tacit knowledge such as text, pictures, diagrams, video and animation. Moreover, auditory representation can consist of narration or commentary, instructions, and cues to represent educators' tacit knowledge.

Learners' Internalization Process

This is the process of transforming explicit knowledge codified by educators into learners' tacit knowledge. Online learners internalize their experiences by reading syllabuses and course materials. Not only do online courses provide structured lessons with well-designed programs, they also offer simulated representations in any combination of media formats, such as text, image, and video. Thus, online learners can study the course and internalize their own knowledge. Additionally, the hypermedia environments with search tools allow online learners to determine the browsing sequence, to add to the information for making it more personal, or to build and structure nodes and links, thereby forming a network of ideas in the knowledge base (Jonassen, 2000).

Through internalization, explicit knowledge created by educators is shared throughout a knowledge creation center and converted into tacit knowledge by online individuals. Internalization is related to `learning by doing' (Nonaka, Toyama & Konno, 2000). Explicit knowledge can be embodied through simulations or experiments that trigger learning by doing (Nonaka, Toyama & Konno, 2000). By conducting the meta-search and navigation systems, online learners not only follow a knowledge map to self-directed learning, but also build their personal knowledge bases.

Learners' Socialization Process

Tacit knowledge becomes explicit through interaction (Schwen et al., 1998). Tacit knowledge can be transferred from one individual to another and from individuals to groups through conversations, dialogues and meetings (Kermally, 2002). Basically, learning is a social activity. Ideas and shared goals are continually contributed to the online learning community. Generally speaking, an online learning community can be used to foster socially shared cognition through synchronous and asynchronous communications. For example, discussion boards help other learners to learn the course topics by the common understanding that forms the basis for discussion and knowledge exchange (Consway & Whittingham, 2001). By building discussion questions around definitions and making learners retake questions until they have given the agreed answer, online learning helps reinforce shared understanding across the group (Consway & Whittingham, 2001). Thus, "knowledge is integrated into the learning environments through sharing values, beliefs, languages, and ways of doing things" (Trentin, 2001, p. 10).

Social and advanced technological media enable advanced knowledge to process as knowledge creation systems because they engage all learning groups in the dynamic knowledge creation. Social interaction and negotiation promote the idea of supporting interaction and collaboration to manage knowledge. Knowledge can be tacit and be transferred through participation in social

groups (Sorensen & Lundh-Snis, 2001). A virtual discussion group lets learners share new insights. In Van Aalst and van der Mast's (2002) research, the use of knowledge sharing solution showed more positive experiences with online learning. In short, knowledge transfer and creation are processes that formulate knowledge in social activities.

A summary of the framework of knowledge creation for online learning environments is shown in Figure 1.
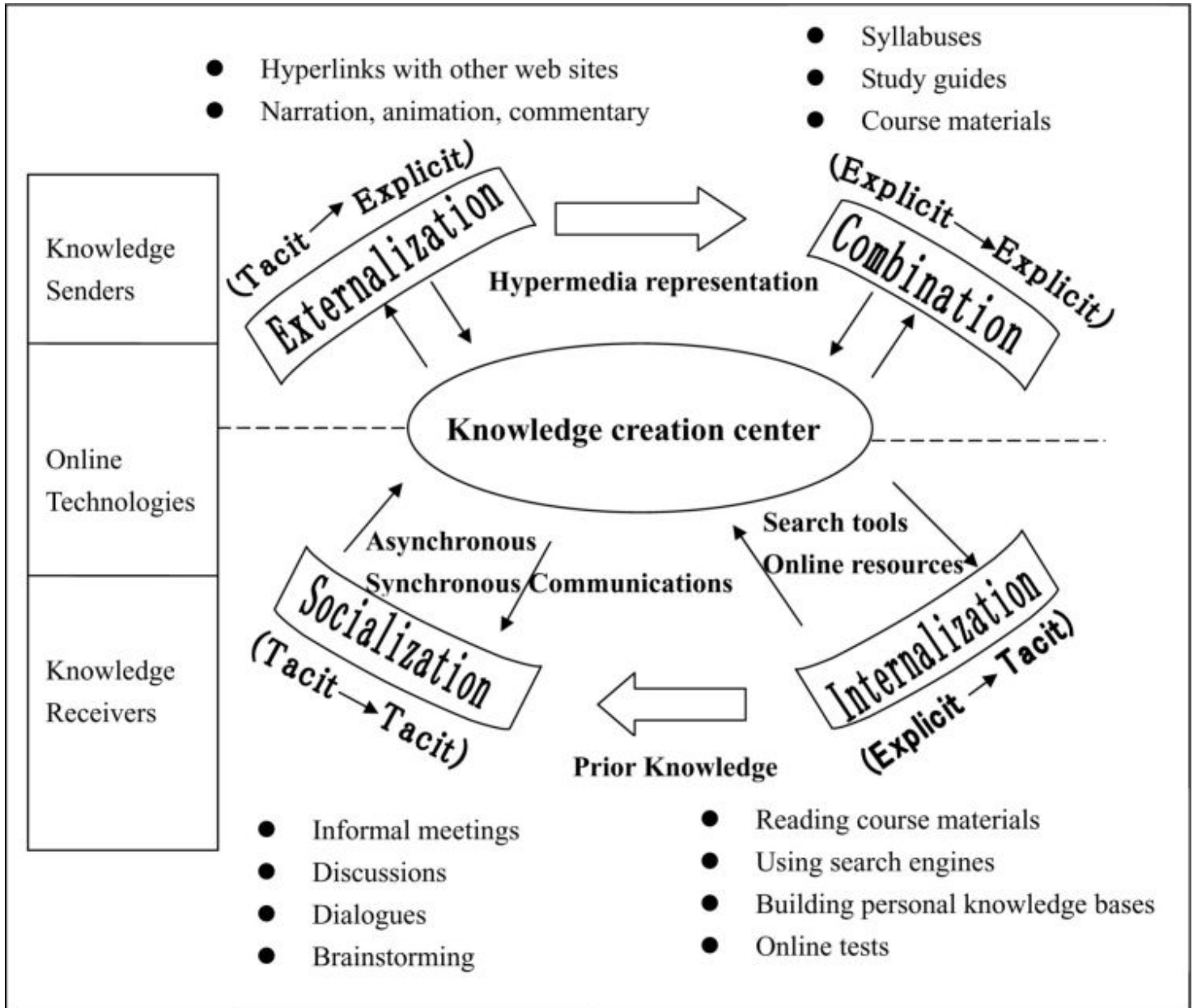

Figure 1. Framework of knowledge creation in online environments.

Features of Knowledge Creation in Constructivist Learning

"Knowledge creation is achieved through recognition of the synergistic relationship between tacit and explicit knowledge in the organization, and through the design of social processes that create new knowledge by converting tacit knowledge into explicit knowledge" (Choo, 1996, p. 334). The benefits of creating and improving upon the knowledge creation center are discussed as follows.

Improve the Representation of Existing Knowledge

Knowledge can be obtained from experienced and skilled persons (Choi & Lee, 2002). Educators classify and categorize knowledge for storage and retrieval purposes. Explicit knowledge is easily formalized and expressed by information processing technologies (Choi & Lee, 2002; Liebowitz & Wilcox, 1997). An online learning environment enables the media to codify and store knowledge for learners to access and use it, thus educators collect knowledge from multiple sources and make it available to online learners via multimedia representations.

Mclnerney (2002) argued that educators must understand the dynamic nature of knowledge itself in order to practice effective knowledge management in multi-disciplinary contexts. It is in this very act of conversion from tacit to explicit knowledge that learning is created. It is also crucial for educators to focus on effective methods of delivering content, the media used, and the overall quality of the instruction materials.

Speed Up Learners' Problem Solving Processes

Learners can acquire knowledge by being taught, by seeing an example of how another learner solve a problem, by analogical transfer between unrelated domains, by reasoning from deep structures such as from books, or by observation, experimentation, and discovery (Michaelson, Michie & Boulanger, 1985). "Practice is what converts tacit knowledge into explicit knowledge" (Sorensen & Lundh-Snis, 2001, p. 85). Therefore, the methods of constructivism place great emphasis on the development of learners' ability in solving their real life problems by applying learners' knowledge.

After a course unit has been completed, online learners might be asked to create a report on the topic learned throughout the course. This approach asks online learners to capture and archive knowledge. Hence, their efforts are used for solving problems. Sometimes, the same group might convene and create a presentation that summarizes the main aspects of the project that were valuable in gaining knowledge. The report or the video presentation would be artifacts representing the gained knowledge that could benefit other learners as well. Eventually, these knowledge artifacts would comprise of a collection of materials that could be codified and placed in a repository for everyone to access in the online learning community. Through knowledge creation, the insights of individuals are converted into knowledge that can be used to solve problems or improve learning performance.

Provide an Effective Way of Self-Directed Learning

Self-directed and self-paced learning are features of an online learning process (Consway & Whittingham, 2001). Learner autonomy increases the opportunities of finding valuable information and motivates learning groups to create new knowledge (Nonaka, Toyama, & Konno, 2000). Since online learners have greater responsibility on their learning, they take control of their learning processes and their purpose of learning. When materials are presented in online courses, they are expected to access course materials, and find resources to complete assignments for knowledge internalization. The digital library is one example that is capable of organizing, producing and updating online materials.

Online learners can learn individually by using a search engine to find online resources. That is, it is necessary to consider autonomous individuals constructing their knowledge based on their own experience. They can personally construct knowledge from internal representations based on their prior experience. So, knowledge is internalized to become part of learners' tacit knowledge bases in

the form of technical know-how.

Construct Learner-Focused Knowledge

For constructivism, the role of an instructor is a facilitator (Ornstein & Hunkins, 1998). Online learners are expected to set their study objectives, know what they want to learn, find resources and evaluate their learning process to meet their goals (Cranton, 1994). Online programs preserve and increase opportunities for adaptation to individual differences. By using search engines, online learners use the Internet freely to access unstructured materials in order to pursue and discover knowledge and to build personal knowledge. More simply, this is the concept of learners choosing their own learning objectives and behaviors to construct and control much of the learning process. Therefore, learners have different capacities for making decisions about their own learning. As a result, the knowledge creation center provides a personally relevant context, promotes autonomy, and helps to develop online learners' abilities that support the knowledge management.

Promote Collaborative Learning

Tacit knowledge could be used in the autonomous performance of tasks or problem solving. Vygotsky's ZPD implies that the individual has some knowledge, but needs help in performing tasks that depend upon that knowledge. The design of learning environments should enable learners to make their knowledge explicit and visible to others. Learners should also be engaged in taking a common task and solving a common problem (Lewis, 2001). In knowledge management, well-experienced learners can find the information and knowledge they need quickly and effectively and they can post their knowledge for others to access (Gurteen, 1999).

Tacit knowledge is not only internalized, but represents the learning group in which people function as asserted by the distributed cognitive approach. From this perspective, a collaborative knowledge creation is greater than that of an individual. The reason is that each person can support the cognitive development in the group by providing or sharing knowledge with others. As a result, the purpose of group discussions is to foster online collaboration and reciprocal learning among online learners. Technology not only assumes the role of managing explicit knowledge using databases; it also acts as an effective support tool to facilitate group interaction. As a result, online learning is based on sharing experiences, identifying best practices, and reciprocal support for solving daily problems that may arise in one's life.

Knowledge Sharing is a Spiral Process for Online Learners

"Knowledge is dynamic, not only in individuals, but also in the organization's knowledge where there must be movement for knowledge to be transferred or shared" (Mclnerney, 2002, p.1010). The main function of knowledge creation is to encourage knowledge sharing through networking. Knowledge can be socially constructed based on experience. Gains from knowledge creation include the recycling of exploration through the sharing and synthesis of knowledge among different social groups and communities (Sorensen & Lundh-Snis, 2001). Having a static collection of knowledge, codifying it, and placing it in a courseware is not really sufficient for knowledge to be used effectively. Tacit knowledge accumulated at the individual level can then turn into a spiral of knowledge creation through a socialization process (Nonaka, Toyama & Konno, 2003). The process of dynamic knowledge creation occurs during socialization when tacit knowledge is made explicit. This spiral, continuous knowledge creation that operates between tacit and explicit knowledge continually affects new knowledge among discussion groups, thereby creating new knowledge.

Instructional Strategies for Knowledge Creation

Basically, there are two approaches to defining knowledge. One group of researchers regards knowledge as an object that can be stored and manipulated (Zack, 1999). Another group focuses on the analysis of the process of application (Bohn, 1994; Kogut & Zander, 1992; McDermot, 1999). To guide knowledge educators, the framework of the online learning environment was integrated into the two key ingredients of knowledge in order to design the following strategies.

Multimedia Environment Facilitates the Deposit and Codification of Knowledge

Online technology is a mediator of codified representations and promotes the view that knowledge can be managed by codification (Sorensen & Lundh-Snis, 2001). The framework of knowledge creation is discussed here with either explicit or implicit position on how the knowledge is created. The appropriate use of online technology helps learners gain conscious control of tools for learning that they can use to develop the ability of knowledge management. The framework is designed to increase certain aspects of the ability to learn and to increase knowledge itself. Educators need to become skilled at converting personal, tacit knowledge into explicit knowledge that can help learners to construct their own knowledge. These technologies can make a great contribution to the educators' ability to transfer and share valuable knowledge to online learners.

In general, the significant components in an online program are the content, instructional objectives, characteristics of the students, length of the course, the media and teaching techniques employed to represent the explicit knowledge. Moreover, such hypermedia environments, like visual, auditory, hyperlinks and video, allow the rapid dissemination of knowledge, thus making tacit knowledge explicit. As a result, online courses with videos, audio and animations are Web technologies that facilitate instructors to store their tacit knowledge externally. Therefore, the knowledge creation center is a knowledge portal for online learners to access knowledge repositories, which are core knowledge created by educators. These course materials and instructions make it visible for online learners and greatly contribute to individual development and management core competencies. To help online learners capture knowledge easily, educators might use hierarchical trees or knowledge maps to guide learners to access the knowledge.

Educators Design Project-Based or Case-Based Assignments

Generally speaking, knowledge is not tied to any external reality. Thus, educators can design learning activities that are highly connected to the external world and online learners can use search engines to look for topics such as a project report related to the external world. A learner who is not motivated will not really perceive a problem, so problems selected for study should be derived from learner interests (Ornstein & Hunkins, 1998). In this way, problem solving and knowledge discovery come together. In other words, knowledge is dynamic and is built around the process of discovery (Dewey, 1916).

Provide Adaptive Learning

In contrast to face-to-face learning, online learning environments promote individual learning. Learners can decide what to learn and when to learn, even control their learning pace. The online learning environment not only presents well-structured instruction such as CAI (computer aided instruction), but also offers online tests for learners to reflect on or practice what they have learned. In this situation, online learners have more opportunities to learn what they need to learn based on learners' individual differences. With respect to the individual differences, the knowledge

center can be treated as a large database that provides the different levels of learning materials. Thus, online learners can select an appropriate learning level based on their prior knowledge. The aim of this strategy is for learners to create knowledge dynamically based on their needs, preferences, and their reactions to actions.

Encourage Knowledge Sharing and Collaborative Learning

When the knowledge center is created, networks of knowledge learners provide an alternative environment to the collaborated learning space. Learners who ask and respond to questions are actively engaged in the learning experience and the knowledge creation process. Thus, joint assignments can give learners more opportunities to collaborate with other online learners. A presumption of the knowledge center is that online learners can actively contribute their knowledge, either tacit or explicit. Thus, educators need to encourage online learners to share individual knowledge by using reward policies such as counting the number of posted messages into the grading scheme.

Knowledge can prove to be an added value when educators and learners contribute their new and useful knowledge to the center. Knowledge creation and construction are important processes for learning. Learners make sense of knowledge in social activities that are deeply impacted on online learning. This strategy, rather than aiming at capturing knowledge, would instead focus on facilitating interpersonal communities, improving retention or possibly improving the learners' abilities to improve their specialized knowledge. Moreover, it concentrates on maintaining diverse and comprehensive skills among online learners.

Limitations and Issues

Shin et al., (2001) proposed that knowledge should be discovered and applied in any form; knowledge makes great contributions to human actions such as decision-making; knowledge can be transferred via interaction. However, a challenging task for knowledge management is to provide learners with more flexible learning methodologies to meet their needs. Moreover, there are some disadvantages such as disorientation, over-rich information and ineffective user-interface in Web-based learning environments (Liaw & Huang, 2002). In addition, the framework proposed in this paper has the following limitations and issues.

Difficulty of Codified Knowledge

In fact, most researchers are interested in the common question - "Can all knowledge be codified?" Explicit knowledge is formal knowledge that is easy to transform from educators to learners. It is frequently articulated in the form of syllabuses, study guides, and course materials. Thus, explicit knowledge is processed, transmitted and stored with relative ease. On the other hand, tacit knowledge is highly personal and is a comprehensive cognizance of the human mind. Therefore, tacit knowledge is of limited representation to learners. Moreover, it is difficult to communicate tacit knowledge to others. As a result, educators try hard to apply narration, animation and commentary to represent individual knowledge as effectively as they could.

Knowledge Quality

The quality of information is one of the most important factors that affect the transformation of individual knowledge into organizational knowledge. In online learning environments, learners usually have strong self-direction in learning, so they are actively retrieving information. After that,

they contribute to the creation of a knowledge base. As a matter of fact, a lot of responses from fellow learners would be ineffective, incomplete or even erroneous if there were no monitor or control from knowledge educators. The problem is most serious when a knowledge base is growing and other learners continue to use it. If this problem deepens, it might make an adverse impact on knowledge sharing and ultimately on knowledge creation. Thus, reapplying the individual's knowledge and controlling the quality of the knowledge base are thought provoking and important issues for this framework.

Immediate Feedback

Compared to a face-to-face learning environment, this could be another interesting question for researchers - "Does the online learning environment encourage more knowledge construction for learners?" In general, educators predetermine what their learners need in an online course. Thus, knowledge educators transfer explicit knowledge by engaging in the planning of syllabuses, study guides and course materials. They try hard to transfer their tacit knowledge; even through an online course designed by hypertext or hypermedia. However, from the learners' perspective, they might not understand it completely, since they might want to interact with the educator to help them to construct their own knowledge. Generally speaking, online learners cannot communicate with the educator as readily as they would enjoy in face-to-face learning. This problem is especially evident and pressing when online learners encounter questions with preprogrammed instructions. Thus, synchronous communication remains an essential part of communication in a distributed environment.

Conclusion

Given the dynamics of our highly competitive global economy, the needs for lifelong learning and knowledgeable workers have never been stronger. Likewise, online learning has an incredibly important position in the information age. Creating a knowledge center for distance instructors and learners is one of the important ways for us to maintain our value in today's competitive global economy.

The role of technology in this article lies not only in the management of knowledge, but also in interpersonal communication. Thus, online communities provide an environment for learners to acquire and share tacit knowledge through interpersonal interaction (Choi & Lee, 2002). In addition, online learners disseminate or access online resources by using search tools to create their knowledge. This leads to a new way of viewing knowledge management, one which is based on sharing experiences, identifying best practices, and reciprocal support in learners' daily problem solving. Thus, knowledge educators should not merely manage knowledge but create it as well. Each learner of the learning society needs to be involved in the knowledge creation, with group learning acting as the main organizers of knowledge. In future research, intelligent agents can be applied to help reduce information overload and to improve the search performance of online learners. In addition, the expert system can help knowledge educators to create and retrieve knowledge more effectively in knowledge creation.

An application procedure of the framework could be empirically tested. There might be other research questions in the area of knowledge management, concerning not only knowledge management strategies, but also the instructional design of knowledge management. These issues include usefulness of the content representation of knowledge, quality of knowledge creation, differences of learning performance in the design of instructional management between knowledge

management systems and traditional information and communication systems as well as the most important one, how tacit knowledge can be codified fully.

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