

Developing e-Learning Architectures for Communities of Practice: A Knowledge Perspective

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Abstract

This paper describes the initiative to develop e-learning architectures for online education services suitable for university or corporate learning environment. The idea is to create networked collaborative learning experiences that invite individuals to construct knowledge and to make meaning of their worlds of interactions. In particular, we discuss the educational framework of our design from the perspectives of cultivating an organization's e-learning strategy for collaborative learning in the form of communities of practice. We also characterize the major assumptions underlying such communities, and describe the individual and social aspects of e-learning support to be realized through appropriate constructivist design of organizational components. The paper concludes by discussing the challenge of integrating processes and knowledge into e-learning implementation from the viewpoint of change management.

Keywords: e-Learning, Communities of Practice, Knowledge Sharing, Learning Organization, Constructivism

1 Introduction

As online technologies and information resources rise in salience, it is believed that online education must be based on theories of learning and instructional design principles to guide usage of the tools and resources for mediating collaboration and social exchanges within communities of learners. Recent discussions in the literature [6, 18, 21, 37] suggest that learning is increasingly viewed as a constructive process occurring during one's participation in and contribution to the practices of the community. This is supported by a current shift [4, 25] in classroom teaching from the cognitive focus on knowledge structures presumed in the mind of the individual learner, to a constructivist focus on the learner as an active participant in a social context. Indeed, we have been witnessing classroom learning being enriched with tools (WWW-based tools) that mediate knowledge building and social exchanges among peers as participants in discourse communities [2, 3, 8]. These 'communities' render opportunities for learners to interact with multiple perspectives, which not only challenge their existing knowledge constructions but also impose cognitive conflicts [21] requiring negotiation. This paper describes our initiative to design suitable e-learning architectures aimed to enhance learning and knowledge sharing in the learners' communities referred to as the *communities of practice* (CP) [29, 38, 39] through the idea of organizational learning. We are convinced that a strategic foundation

for e-learning is essential to develop the collective intellect of the CP in terms of its social and intellectual interactions. Also through the appropriate use of information and communications technology (ICT) [12] we are developing some experimental e-learning examples to test our ideas with constructivist design to adapt our CP-based learning to both the individual and social aspects of today's e-learning challenges. The paper closes with our reflection on change management in constructing e-learning support environment.

2 Pedagogical Background

The pedagogical background [19, 22, 28, 29, 38, 39] behind the idea of communities of practice lies in a simple but workable concept of creating communities that ground their professional growth on mutual learning processes. Basically, if a problem arises, help can be sought from someone who is likely to have already tackled that problem. If the suggested solution is understood, learning has taken place, which will then increase know-how to be distributed among the community members. Even if no immediate solution is found, it is possible to seek allies in the search for one. This collaboration will bring about collective growth in the community and problem solving is thus aimed to increase the community's shared knowledge base. Lev Vygotsky's theory [37] suggests that we learn first through person-to-person interactions and then

individually through the internalization process that leads to deep understanding. This belief in the social process of knowledge sharing is becoming increasingly popular in today's interactive classroom led by skillful teacher intervention. What is certain about the emergence of ICT tools [12] is that we now have the technological means to provide and to optimize communications within groups of individuals outside face-to-face meetings or informal discussion. Within and without an organization, ICT enables different communities to do circulation of information and material (explicit knowledge) or of opinions, suggestions, and know-how (tacit knowledge) that have not been codified in a text/manual or other support channel. According to Nonaka and Takeuchi [20], explicit knowledge expressed in words and numbers can be distributed as data, scientific formulae, product descriptions, manuals, or basic principles. It is easy to transmit explicit knowledge in definite and organized form, to manage on a computer, communicate by network and store in a database. In contrast, tacit knowledge is highly personal and difficult to define, which also makes it hard to communicate and share. It embraces subjective perception, intuition and foresight, and is firmly rooted in personal experience. In order to spread tacit knowledge, it needs to be transformed that everyone can understand. Often it is this very act of tacit-to-explicit conversion that CP-based organizational learning is involved [19, 30]. And it is this learning experience to enable knowledge development and transfer among our participants in an interactive and collaborative atmosphere that we intend to develop into our e-learning architectures. Pedagogically, we encourage our students to actively participate in generating, accessing, and organizing their information of interest. They then construct knowledge by formulating their ideas into words and develop these ideas as they react to other students' or teachers' responses to their formulations. Knowledge construction can thus be considered as the process of progressive problem solving, which encourages students to be innovative, create intellectual property, and develop and acquire expertise.

3 A Contextual Definition of e-Learning

There have been many terms to describe the use of technology for learning. E-Learning [24] refers to the use of Internet technologies to deliver a broad array of solutions that enhance learning and knowledge sharing. It is networked, which makes it capable of instant updating, storage/retrieval, distribution and sharing of instruction or information. It also focuses on the broadest view of learning – learning solutions that go

beyond the traditional paradigms of training to include the delivery of information (knowledge) and tools that improve performance. Besides, the 'e' in e-learning has additional connotations other than the usual electronic context [17]:

- *e is for Experience.* The typical drivers for e-learning are about changing the character of the experience of learning in the organization. A learner in an e-learning offering would have the options of time-shifting, place-shifting, granularization, simulation, and community support. These all go to the heart of evolving and increasing the experience level.
- *e is for Extended.* With e-learning an organization should be able to offer an extension of learning options, moving from an event perspective to an ongoing process. The footprint of the e-learning experience would be larger in terms of time and would linger with the learner throughout their later careers.
- *e is for Expanded.* The opportunity to expand training offerings beyond the limitations of the classroom is highly encouraged. Can we offer learning to audience-in-the-large, say globally? Can we offer access to an unlimited number of topics? Can we not be constrained by our training budget when it comes to meeting a student/employee request for knowledge?

4 A Strategic Foundation for e-Learning

It is believed that the easiest part of implementing e-learning is the technology. The toughest part is to invent and innovate the context to create new models of experiences for delivery with this technology. The interesting part is how to blend the well-known classroom learning and e-learning in appropriate and supercharged ways. On conceiving the strategic foundation to accommodate the development of e-learning among communities of practice, we find the notion of learning organization (LO) [9, 26], quite compatible for our purpose. According to Senge [26], a learning organization is "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together." With e-learning, we are not just introducing new technology for learning – we are introducing a new way to think about learning. People learn in many ways – through access to well-designed information, by using new performance-enhancing tools, through experience, and from one another. In order to leverage

the potential of e-learning technology for sustained, beneficial change for an organization, we need a sound people-centered strategy. There are a number of factors influencing this strategic foundation for e-learning according to Rosenberg [24]:

- *New approaches to e-learning.* These could include online training (the instructional orientation) that provides courseware and business simulations, and knowledge management (the informational orientation) that provides informational databases and performance support tools.
- *Learning architectures.* This is the coordination of e-learning with the rest of the organization's learning efforts. This includes building synergies with other learning initiatives inside and outside the organization.
- *Infrastructure.* This is the use of the organization's technological capabilities to deliver and manage e-learning. From general Web access to so-called learning management systems, the lack of a good infrastructure can stop e-learning in its tracks.
- *Learning culture, management ownership, and change management.* This is the creation of an organizational environment that encourages learning as a valuable activity of the business, supported by senior managers who are truly engaged in the process.
- *Reinventing the learning organization.* This is the adoption of an organizational and business model that supports rather than limits the growth of e-learning. New approaches to learning will require new approaches to running, professionalizing, and measuring the learning function. It is believed that the more facilitative these approaches are supporting, rather than hindering, e-learning initiatives, the greater the likelihood that these initiatives can be sustained.

5 Conceiving e-Learning Architectures

In this section, we briefly describe our current efforts of devising learning architectures for CP-based e-learning. Specifically, these architectures should fit within an actionable framework for a learning organization [9, 14, 15] skilled at creating, acquiring, and transferring knowledge and at modifying its behavior to reflect new knowledge and insights. As learning architects, we consider these architectures as organizational components that can be developed and implemented to support a LO-based e-learning strategic foundation. For the sake of clarity, we use the term 'e-learning architectures' to imply the injection of technological capabilities into the following learning architectures.

- a) *IS-related Component.* This component operates on the information systems (IS) paradigm [14, 15] of identifying relevant data, acquiring it, and incorporating it into storage devices (databases) that are designed to make it readily available to users in the form of routine reports or responses to inquiries. Principally, IS directly relates to managing data and information rather than to knowledge and learning. But, the IS network (or infrastructure), including application programs which transform data into more valuable information relating to particular decisions, functions or activities in the organization, is of fundamental importance to implementing any of the other e-learning architectural components. An organization that chooses to employ an IS-related strategy does so by creating databases, inquiry capabilities, communication capacities and other leading-edge infrastructure elements to enable and facilitate collective learning, information sharing, collaborative problem solving and innovation.
- b) *IL-related Component.* The individual learning (IL) component focuses on the training and education of individuals. This approach maximizes the opportunities for both formal and informal learning through the institution of workshops, apprenticeship programs and the establishment of informal mentoring programs. Typically an IL component provides free use of the IS network to access unstructured material in order to pursue an explicit educational path (like going into an enormous library to look up material on a given topic), and to access structured learning material purposely designed for online self-learning. More, an effective IL component requires focus on both explicit and tacit knowledge. While explicit knowledge can be transmitted formally, the transfer of tacit knowledge (existing in the minds of the experts) can be observed only through its application and can be acquired only through practice [9]. This implies the provision of support from the material providers such as tutors and teachers (sometimes operating as organizers of events like short online workshops dealing with different topics). The organization that adopts the IL component in pursuit of a LO is betting on its people; namely, enhanced individual learning will translate into improved organizational behaviors and performance.
- c) *OL-related Component.* The organizational learning (OL) component focuses on the idea that learning by a social system [23] cannot be equated with the sum of the learning processes undergone by individual learners. This component is characterized by the use of communities of practice approaches, leading to the formation of collaborative groups composed of,

for example, course alumni or professionals who share experiences, knowledge, and best practices for the purposes of collective growth. This component may also be thought of as pursuing the creation of social capital in the organization [10, 14]. The conceptual basis is that social capital, in the form of various group and organizational competencies and capacities, can be developed, refined, and enhanced to enable the organization to adapt to changing circumstances and demands, through such processes as teamwork, empowerment, case management or development-focused career paths. The organization that pursues the OL component to create a LO, must facilitate group learning and group capacities for dealing with change so as to enhance the organization's ability to respond to change.

- d) *IPM-related Component*. This component deals with the issue of intellectual property management (IPM) [40] underlying the activities that are involved in leveraging existing codified knowledge assets in the form of patents, brands, copyrights, research reports and other explicit intellectual property of the organization. This is accomplished by creating repositories of explicit knowledge and refining and distributing it through the IS network. The conceptual basis for this component is that such codified knowledge may be thought of as a realized human capital [1] from intellectual property. The organization that pursues the IPM component to create a LO may devise an incentive scheme that allows individuals and groups to be rewarded for the creation and leveraging of such property.

6 Communities of Practice and Knowledge Sharing

In a networked learning environment, Trentin [29] describes 'communities of practice' (CP) as self-managing, virtual learning groups. There professional growth is based not so much on delineated learning paths (onsite or distant courses) but rather on experience sharing, the identification of best practices, and reciprocal support for tackling day-to-day problems in the workplace. This type of learning can be defined as mutual or reciprocal learning in order to distinguish it from other collaborative learning strategies that might be called directive learning, wherein someone manages or steers the learning process, say, in fully fledged interactive courses within online education. Moreover, according to Wenger [38], CP presents a theory of learning that focuses on engagement in social practice as the fundamental process by which we learn and so become who we are. The primary unit of analysis is the informal CPs that people form as they pursue shared enterprises over time. In order to give a social account

of learning, the theory explores in a systematic way the intersection of issue of community, social practice, meaning, and identity. The result is a broad conceptual framework for thinking about learning as a process of social participation. To capture these pedagogical ideals into the architectural design of our e-learning support environment is more an ongoing iterative process than a one-time activity. Nevertheless, we have started from the following assumptions concerning communities of practice [29, 38, 39]:

- a) *Learning is fundamentally a social phenomenon*. People organize their learning around the social communities of which they are members. Engagement in social practice is the fundamental process by which they learn and so become who they are. Schooling becomes powerful learning environments only for individuals whose social communities coincide with the school.
- b) *Knowledge is integrated in the life of communities that share values, beliefs, languages, and ways of doing things*. The primary unit of analysis is the informal CP that people form as they pursue shared enterprises over time. Real knowledge is integrated in the doing, the social relations, and the know-how and expertise of the communities.
- c) *The process of learning and the process of membership in a CP are inseparable*. Learning is inseparably entwined with membership in a CP. What holds them together is a common sense of purpose and a real need to know what the other knows. As they change their learning, their identity (relationship to the group) changes.

There are at least two situations in which e-learning can gain from the establishment of a community of practice. Namely, the need for follow-up to a course (be it conducted face-to-face or over the Internet) through self-help among course alumni; and the need to create communities of professionals based on the concepts of knowledge sharing.

- *The community of course alumni*. Training courses (especially face-to-face ones) are not always long enough to guarantee the complete acquisition of the knowledge and skills dealt with. In fact, such courses are more informative than formative as far as training is concerned. The most critical moment arrives following the conclusion of a course, when individual participants attempt to apply what they have learned, relying totally on their own resources. Also, mastering the main course contents does not necessarily mean being able to put that knowledge into action. When difficulties arise, the sense of isolation that is lurking in the background can often lead to de-motivation, and even result in the squandering of the educational and economic resources

that have been invested in the participant. Therefore, there is a strong need for online support in order to provide continuity between training and transfer activities. Such support [31] may indeed be arranged as part of the course or activated spontaneously by the participants themselves. In the former case, it is the course provider who is responsible for offering online support during the transfer phase. In the second, support stems from self-help among the participants themselves. This means the creation of a community of course alumni who keep in touch after the conclusion of the course. In this way, when it comes to applying their new learning, they are able to help one another by socializing the problems faced, and the solutions reached as well as the application strategies.

- The *Communities of professionals*. The idea of knowledge sharing in networked learning has become the motivation behind the spontaneous formation of numerous professional groups today. These groups realize that sharing experience and knowledge offers an excellent opportunity for collective growth in enriching their skills and knowledge on an ongoing basis of collaborative strategies. Often, the sole driving force for joining the community is interest in the topic under discussion: members may be spread over a wide geographical area and might not necessarily belong to the same organization or sector.

7 e-Learning Examples with Constructivist Design

In this section, we describe two current views of constructivist design to be applied in an e-learning support scenario. They are the individualistic view [36] and the social-cultural view [6; 37] of constructivism [7, 13]. The individualistic perspective considers learning as a predominantly individual self-organization through processes such as assimilation, accommodation, and equilibrium. The social-cultural perspective argues that the mind is a by-product of external culturally organized phenomena, such as practices in the context of artifacts, tools and language. Except for the practical difficulty of doing both of these perspectives simultaneously, we notice that there is nothing incompatible in these two proposals. Thus, from a pragmatic point of view, we often consider what the two perspectives have to offer. Namely, we interpret learning as a process of active individual construction and a process of enculturation into the practices of the social community. Brown and Duguid [5] elegantly describe such learning as demand-driven, a social act, and an identity formation. By demand-driven, the learning context should create the active need for reorganization of cognitive processes. By social act, learning is embedded in the larger community beyond the individual; and by identity

formation, learning creates the personality of the learner affiliated to the community of practice through internalization and appropriation of knowledge, skills, beliefs, and norms. For example, a newly trained teacher gets enculturated in school practice and acquires all the rules of the cultural practice as he or she progresses from a novice learner to a mature teacher-practitioner. On the other hand, this newly trained teacher reflects upon what he or she has learned and encounters self-organization – refining theoretical knowledge in relation to his or her practical experiences. Each of the two constructivist perspectives tells us what we should do in our e-learning environment, and they can be used to complement each other.

As an e-learning example, we consider the scenario of students logging onto the university IS network. Information relating to the courses they wish to take, their previous experiences, their modes of learning, is gathered and their personal profile is created. Some type of personalization method [27] can then be used to target instructional content and media to specific individuals based on their profiles. For example, students might have personalized views according to their course profiles, their status (sophomore or senior) and their declared research interests. Personalization can go many levels deeper by tracking the students' content area expertise, the kinds of information sites usually accessed, the assignments undertaken, the lecturers from various disciplines consulted. By keeping a history of the students' activities, the e-learning environment would be able to recommend timely and appropriate resources and materials for the students' learning. It would also be able to recommend directions for the students, say, possible projects or assignments in which the student would most likely be interested. This is often achieved by having the system search databases both locally and internationally. It might even be able to suggest research topics of interest and associate these areas with special interest groups. Essentially, personalization can be designed to guide specific individuals to their most related community or communities by exposing the modules, articles, media that others in the community are viewing or reading. By being able to trace the students' preferences, the e-learning environment is able to associate or affiliate the student with people in the related CP, such as school teachers, university professors, special interest groups, who have similar preferences. Gradually, it is hoped that an identity with such community is formed. From the perspective of both an individual and social constructivist view, we also visualize different virtual learning communities being created where individuals count and there is a process of learning where diverse expertise and perspectives are mutually complemented

and valued. When knowledge is socially constructed, there are notions of negotiation and discourse. Learners are then encouraged to dig deeply into concepts, overcoming misconceptions and queries for understanding.

8 Reflecting on Change Management in e-Learning

We note that constructing e-learning environments requires that we apply knowledge and capability in related areas [11], such as process initiation, knowledge sharing, systems thinking, group dynamics, educational principles, and possibly community memory – recording and analyzing decision making and related history – for recurring and problematic themes ready to be streamlined. Together, these comprise the backbone for communication and cooperative work necessary for online education. Yet too often, we observe a premature inclination to jump to a technological solution without paying attention to those basics. For example, development teams may be overly eager to automate processes that have not been fully defined or used in manual operations. These tendencies reveal wishful thinking that adding technological support will magically allow users to bypass a host of needs and constraints. We need to stimulate new community made up of people and organizations experienced in technology implementation, cooperative work, organizational learning, and process initiation and improvement supported by leveraging individual knowledge through information exchange and by reconciling diverse perspectives. A LO-based strategy for e-learning should establish the capability to understand its environment, including its current activities and work processes, to evaluate what is understood and to initiate improvements where necessary. This capability enables decision making and affects outcomes, representing the combined experience, expertise, and knowledge of all participants involved in a group activity.

Meanwhile, it is believed that each of the previous discussion (section-wise) represents a viable way of beginning the pursuit of an e-learning initiative. In order to support the effectiveness of learning, afforded by some technological and pedagogical possibilities to collaborate with participants and experts over the Internet to access knowledge resources, we need some combination of the enumerated LO-based e-learning architectural components (plus others to be innovated). This suggests that the e-learning environment in the form of an evolutionary LO, is a function of many complex factors, including possibly a well-conceived

time-phased plan in which individual e-learning components are implemented and allowed to mature before new and quite different components are introduced into the mix. According to Levine [16], The underlying plan of transformation is both independent of and dependent on the people in the concerned organization.

- a) *Independent.* Organizations are independent of their members because work processes may exist long after people have left the organization or before new people have come on board. Moreover, viable and effective processes are not dependent on extraordinary individuals to carry them out. By mobilizing multiple perspectives, experiences, and expertise from across an organization and channeling these for decision making, the organization, as a whole, can monitor relevant environmental conditions, continuously adapting its processes to satisfy changing technical and business needs.
- b) *Dependent.* Organizations are dependent on their members and the free flow of ideas. These interactions form the creative source for organizational learning and are the necessary conditions for the ongoing viability of the processes that are created. Interactions through talk, stories and documents sharing, serve a dual role (information bearing and social bonding). To reap the potential benefits of such interactions, through which members of different projects or programs contribute to the same discussion or branched threads, it is believed that most organizations will have to undergo some structural and cultural changes. And such changes often cannot happen overnight.

9 Concluding Remarks for Technological Challenges

Now that we basically learn primarily from discrete events in which we are involved, our LO-based e-learning initiative [32, 33, 34, 35] is developed incrementally through a user-driven iterative collaboration process, which involves our instructional designers, teachers, and students. Using the learning organization as a concrete example, we consider e-learning as a scheme to operate a form of community memory, gathering and distributing data, information and knowledge across the organization. In such learning environments, information systems are geared to improve the interactions between knowledge seekers and the various forms of information providers and knowledge creators. Four basic processes in knowledge asset management are identified [20, 28]: develop new

knowledge, secure new and existing knowledge, distribute knowledge and combine available knowledge. Our environment should make recorded knowledge retrievable or make individuals with knowledge accessible to help learning and adaptation, and our e-learning strategy should help facilitate this and provide the right context for dialogue to enable individuals and groups become observers of their own thinking. As a pervasive infrastructure, it is also believed that our environment should provide the conceptual framework for the integration of information and knowledge technologies from rigid forms of information technology (e.g. databases) to systems supporting dynamic, non-structured, self-evoking knowledge networks (conceptual/cognitive mapping). A measurable challenge is to provide conceptual and IT-based tools that support meaningful connectivity and navigation through these knowledge networks. Overall, the e-learning support must be designed to help organizational members sense and make sense of the environment, foster diversity, document and remember, make decisions and solve problems in a collaborative fashion, namely, 'learning in action'.

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