The Electronic Learning Community: A Framework for Design and Development

Kenneth C. Werbin

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ABSTRACT

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How can a community or organization anticipate, address and satisfy its ever-evolving learning and communication needs in a cost-effective manner? The argument is presented that learning and communication efficiencies can be achieved by employing a framework that fosters the active questioning and re-use of knowledge within communities and organizations. The author names this framework the Electronic Learning Community. In short, an Electronic Learning Community (ELC) is defined as a collaborative, on-line environment that allows individuals in an organization or community to learn, evolve, and interact as a holistic entity by dynamically leveraging extant and evolving knowledge and media assets ubiquitously in day to day activity. Using existing case studies as justification, the Electronic Learning Community is meant to be a unifying framework that ties issues of knowledge management to the implementation of tools and technologies for communication and learning. Additionally, the exploration of the ELC framework is meant to identify research agendas and evaluation questions.

ACKNOWLEDGEMENTS

This thesis is dedicated to my late grandfather Irwin Moss, he who epitomized the value of life-long learning. Special thanks to my family for their constant love and support.

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A. Introduction

In the broadest stroke, this thesis addresses the following question: How can a community or organization anticipate, address and satisfy its ever-evolving learning and communication needs in a cost-effective manner? The argument will be presented that large learning and communication rewards can be achieved by employing a framework that fosters the active questioning and re-use of knowledge within communities and organizations. The author names this framework the Electronic Learning Community.

In short, an Electronic Learning Community (ELC) is defined as a collaborative, on-line environment that allows individuals in an organization or community to learn, evolve, and interact as a holistic entity by dynamically leveraging extant and evolving knowledge and media assets ubiquitously in day to day activity. The Electronic Learning Community is meant to be a unifying framework that ties issues of knowledge management to the implementation of tools and technologies for communication and learning.

This thesis considers two major questions related to the successful implementation of comprehensive electronic learning solutions:

- how is content / knowledge generated and managed in a community or organization?
- how does content / knowledge evolve through its delivery, construction and re-use ?

There is no doubt that in today's world knowledge is the greatest asset of any organization or community. Can a generic framework be created which can facilitate the

assessment of electronic learning needs, point towards knowledge management solutions and indicate possible technological implementations and agendas for communities and organizations of all sizes? The framework of the Electronic Learning Community presented here demonstrates how leveraging knowledge assets through database technology into conferencing systems, shared workspaces, multimedia-based training, simple authoring / presentation tools and desktops has the capacity to transform an organization or community into an intuitive, adaptive, self-sustaining entity capable of keeping its head above water in the midst of waves of change.

In the tumultuous tides of today's information driven world, an organization's or community's ability to adapt is marked by the effectiveness of its decision-making mechanisms. How efficiently, effectively and appropriately is knowledge managed and how quickly can it be employed or re-purposed in meeting pressing needs? Today, measures of cost-efficiency and return-on-investment for learning solutions must be defined by the return-on-time they afford.

This thesis arises out of several years of experience working in the design and development of multimedia based training. What has been observed is that while many organizations would like to evolve as learning organizations, they cannot afford to maintain the constant involvement of the third parties required to conduct the needs assessment, development, evaluation, production and implementation of electronic learning systems. Often, communities and organizations opt for expensive Band-Aid 'solutions', like 'stand-alone' CD-ROM training; static solutions that do not account for their ever-changing information and learning needs. The central argument of this thesis will be that electronic learning needs are best addressed by building and fostering electronic learning communities rather than developing electronic learning products. The term electronic learning product is

meant to refer to non-adaptive, one-off 'multimedia solutions', such as 'stand-alone', static CD-ROM training.

Current practice in many large organizations is to outsource the development of 'electronic learning products' as a solution to complex information and learning needs. Often times, the entire operation of developing electronic learning products is the direct result of succumbing to the 'big wrench' of technology, whereby a specific technology is implemented based on its existence as a fashionable tool as opposed to its effectiveness in providing a learning solution. By the time most electronic learning products are delivered and implemented, their value is near zero due to the obsolescence of the content that they contain. Information, best practice, and knowledge evolve and change. Electronic learning support-products can never reflect their current state.

Today, the exponential increase in the volume of information, content and knowledge that we are exposed to and employ in all of our activities requires a fundamentally new approach to delivering and generating educational content of any kind. Traditional print and media delivery frameworks are not particularly effective when so many of our goals require collaboration and interaction in and around complex content structures. Enter the world of new media learning and communication and the need for a framework to approach the identification and implementation of learning solutions. The Electronic Learning Community represents a learning realm where knowledge is actively managed, constructed, re-used and re-purposed.

The efficiency and effectiveness with which knowledge is generated, used, and managed in a community or organization is directly related to the ease with which that entity can dynamically adapt to changes in society and the marketplace and evolve as a self-sustaining learning community. Static skill and knowledge sets are a thing of the past.

More and more, we recognize that knowledge must be shared within and across organizations and communities. Fostering the Electronic Learning Community necessarily implies that organizations and communities must, at the very least, accommodate for the largest possible scenario of usage when initiating and implementing electronic learning support solutions. No knowledge system today can ever be considered closed, in terms of access, evolution or use.

Overall, the vision and framework of the Electronic Learning Community advanced here reflects a dichotomous set of considerations. The first consideration is current practice and the ideology of forced change adopted by many organizations and communities. This consideration speaks to the limitations of employing static knowledge in electronic learning products. By extension, the second consideration is empowerment: the advancement of the idea that organizations and communities must foster knowledge management skills in all if they are to position themselves to evolve as self-sustaining learning organizations. This consideration speaks to a reflexive, systemic approach that asks, 'what larger systems can be designed around our existing systems that re-purpose knowledge and media and empower us to satisfy our true learning needs?

B. What is an Electronic Learning Community?

In order to elucidate the theoretical underpinnings of the Electronic Learning Community, a deconstruction of the term is provided in what follows.

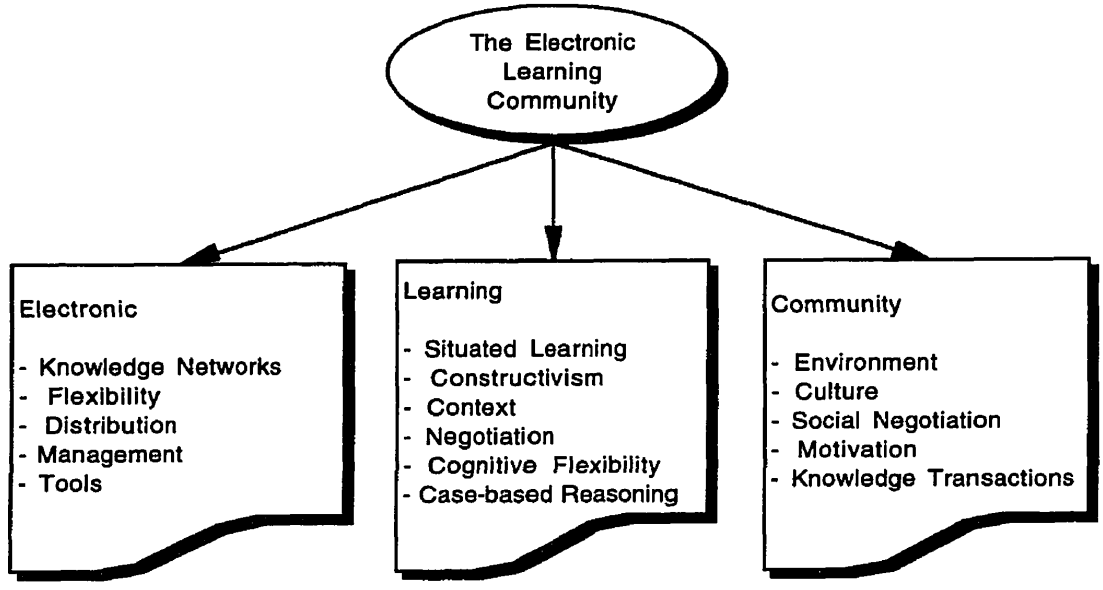

Figure 1: The Electronic Learning Community deconstructed

1. What is meant by Electronic?

At the core, the electronic component of the Electronic Learning Community hinges upon one key feature: the idea of the network as presented in the information systems literature (Tagg and Freyberg 1997; Hirscheim & Klein, 1989; Gibbs, 1994). This literature emphasizes that tightly aligned information systems are a thing of the past. Today, organizations and communities must have systems which are at once flexible enough to deal with any incoming data and secure enough to protect the entity's interests and assets. Information system trends show that the central monolithic information framework (which includes electronic learning products) has fallen by the wayside in favor of smaller interconnected, dispersed systems which support shared data and cooperation amongst many autonomous/semi-autonomous parties (Tagg & Freyberg, 1997).

a) Current Practice

The logic follows that learning systems designed to parallel this trend in information systems will prove to be equally efficient and effective. Yet, current practice in many organizations and communities succumbs to a dated and poorly defined framework of information systems development that presupposes that knowledge is static in nature. Obviously, this cannot account for or support the dynamic nature of evolving organizational or communal knowledge.

The major flaw with current practice is a basic neglect of the idea of document and knowledge management as a fundamental component of activity in an organization or community. According to the Association for Information and Image Management and the Document Management Association (1997), "the integration of imaging, workflow, groupware, document managers, optical character recognition and other technologies , together with realistic standards of compliance and intelligent organizational management of these documents are what make up effective document management."

Document and knowledge management implies that before a 'learning product' can ever be created, technology must be employed that allows for the gathering, retrieval and management of large repositories of learning data. When systems that allow an organization or community to identify, capture and re-use knowledge are in place, the potential return-on-time for initiating a learning intervention can increase exponentially. "Within the instinctive enterprise, return-on-time (ROT), instead of assets or sales, becomes the unit by which return-on-investment is measured. Given the pace of change in a globally competitive economy and the rapid obsolescence of new technologies, ROT may well be the key to long-term success and enduring competitive advantage in the future." (Koloupolos, 1997, pg. 5-6).

b) Distributed Information Systems and Training

According to the distributed information systems literature (Tagg and Freyberg 1997; Hirscheim & Klein, 1989; Gibbs, 1994), each workgroup within an organization has its own operational data needs which cannot be addressed through a central database system. By extension, workgroups within organizations and communities have their own procedural and context specific training needs that cannot be fully addressed by a top down implementation of training, such as a CD-ROM. Central databases within organizations must be used for training as they are used for operation. Information pertaining to the organization as a whole is stored within a central database's confines. Smaller workgroup databases work and sync up with the central database and each other in the streamlined process of distributed information. Information from the central database flows across organizational levels and is peppered with context specific data from workgroup databases.

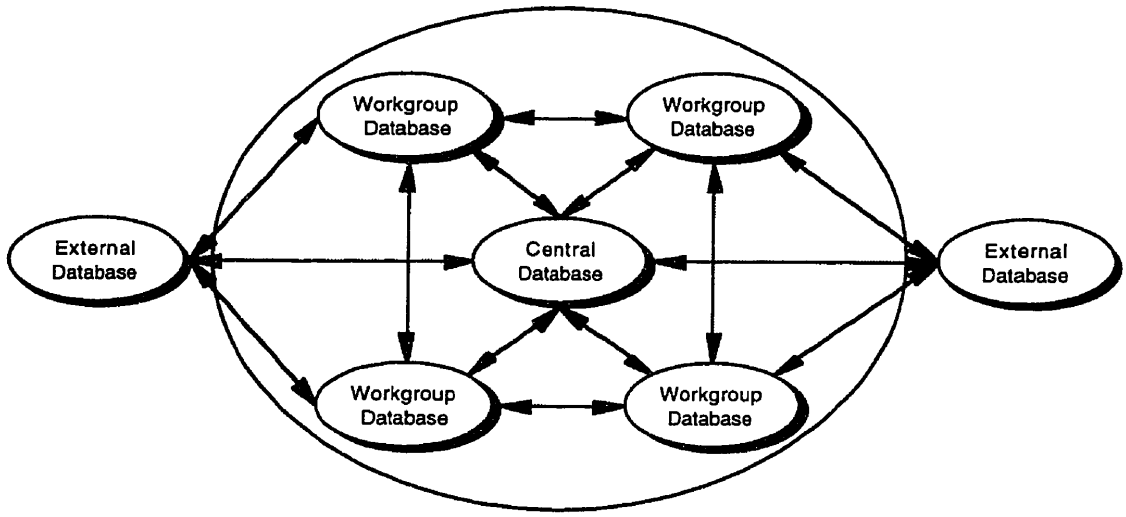

Figure 2: Distributed Information System

Another consideration in distributed information systems design is how to deal with timely information that lies outside of an organization's control and/or database. The same challenges exist in the realm of training and learning. Individuals in workgroups may have to access information from any number of external databases any number of times in a day. Today, a learning system that is not flexible enough to accommodate for the importation of all kinds of external data including all forms of media will inevitably hinder the rate of evolution of the organization or community.

Distributed information systems have proven to be cost-effective and tactical at the operational and procedural levels. Their validity from an educational standpoint lies in their ability to support and distribute knowledge, expertise and decision-making efficiently and effectively. What is lacking today is a comprehensive set of tools that harnesses the power of distributed information systems and facilitates the development of knowledge in the form of shared knowledge structures. The field of distributed cognition (Norman, 1988, 1991) is of interest here in terms of it's concern for artifacts, tools and the application of stable design principles in systems. Tools mediate and allow for the inter-negotiation of meaning between people and objects in a community of practice. By virtue of their use, tools are considered artifacts of a community, containing knowledge in and of their physical structures.

In his discussion of 'activity-based tool design' Clancey (1997) emphasizes that enabling the creation of shared conceptual constructs requires collaborative tools that support problem-based activity. In a community, tools that allow for the re-use of shared knowledge require that knowledge be defined as problems or questions in order to be re-purposed in the face of future uncertainty. No two problems are exactly the same. Tools must assist learners in isolating and locating knowledge that is pertinent to the present situation at hand and at the same time facilitate the creation of new solutions. Tools enable

the creation and construction of knowledge at all levels of an electronic community or organization. Tools that mediate generative knowledge growth in a distributed information system are the essence of the electronic component of the Electronic Learning Community.

2. What is meant by Learning?

The 'learning' element of the term Electronic Learning Community draws primarily on the socio-cultural (situated) approach to learning (Lave & Wenger, 1991; Chai & Hannafin, 1995; Burton, Brown & Fisher, 1984; CGTV, 1990; Brown, Collins & Duguid, 1989; Perkins & Salomon, 1989; Brown & Duguid, 1991). Coupling distributed information systems with networked communication tools has created learning challenges that are based on context (Nardi, 1996; Bellamy, 1996; Kyng, 1995), rapid changes in organizational memory and the customization of learning materials (Rappaport, 1997).

While the Electronic Learning Community is driven by a knowledge-based system, the root idea of learning stands in contrast to cognitive, rule-based learning systems (Newell & Simon, 1972; Pylyshyn, 1991) where knowledge is represented by current states, goal states and cantilevers which bridge gaps . In rule-based systems, the expertise of individuals is only modeled in terms of a single knowledge base. The collaborative development of shared models is not considered. By contrast, the situated approach to learning and, by extension the ELC, conceives of goals as articulated within context specific activities.

a) Situated Learning

The term 'situated learning' arose from the philosophy of constructivism (Vygotsky, 1978) which presents the notion that individuals construct their own reality.

From an educational perspective, this has numerous implications including understanding the learner as an active entity, constantly striving to make sense of the world through their engagement in activity and exposure to stimuli (Perkins, 1991). A constructivist approach to learning implies that learners are not information banks, but are rather active interpreters of experience who hypothesize, elaborate, test, refine and construct mental structures in all aspects of their day-to-day lives. Constructivism, and by extension situated learning, emphasizes the social nature of cognition where meaning and knowledge are negotiated, and where "...individuals have opportunities to test their constructed ideas on others, persuade others of the virtue of their thinking, and be persuaded" (The Cognition and Technology Group at Vanderbilt, 1991, p.16).

Part of the idea of situated learning comes from in the notion of legitimate peripheral participation (Lave and Wenger, 1991) which seeks to address the question of how newcomers are initiated into communities of practice and what effects they have on the evolution of communities. The idea is that knowledge is distributed among members of a community of practice and meaning is constructed socially. Legitimate peripheral participation in a community of practice implies that context dictates activity and learning is achieved by doing. "Legitimate peripheral participation is proposed as a descriptor of engagement in social practice that entails learning as an integral constituent." (Lave and Wenger, 1991, pp. 35). The classic midwife example demonstrates the induction of newcomers into a community of practice via legitimate peripheral participation; the young daughter of a midwife boils water and brings her mother clean sheets at 2 am during the birth of a child because there is no one else to perform these tasks. Learning occurs naturally, understanding is achieved by doing. This form of learning cannot be considered as a replicable phenomenon. Rather, this form of learning occurs in activity, bound by context (Perkins and Salomon, 1989) and based on the social negotiation of meaning, the root idea of constructivism.

b) Context

The situated view is that context cannot be reduced to mere description. The definition of problems, the conception of goals and the creation and use of knowledge is firmly nested in activities. Goals and problems incubated in activities are participatory, socially constructed (Lave and Wenger, 1991) and dependent on any number of environmental variables.

Following situated learning's emphasis on the emergent, contingent nature of collaborative human activity, a discussion of context related to the ELC is best summed up as the relations between the individual and the environment in which they are immersed, including the culture of the organization or community. Nardi's (1996) discussion of context as related to activity theory (Leont'ev, 1974, 1978 in Nardi, 1996) emphasizes that activities are composed of subjects, objects, artifacts, actions, goals and operations which are not fixed but emergent based on changing conditions. "Context is constituted through the enactment of an activity involving people and artifacts" (Nardi, 1997, pp.76). The construction of context is a fleeting, generative process whereby all of these factors converge when one engages in activity.

"Activities.... develop within ongoing activities" (Clancey, 1997, pp.271). Everything that an organization or community does from the development of strategy to its execution, is contingent upon pre-existing activities. By extension, knowledge is socially developed within activity. Therefore to claim that one person is solely responsible for any specific knowledge is to deny the social influences that lead to the activity in which the knowledge was constructed. By the same token, to claim that learning is replicable is to deny the community of practice in which the opportunity for learning evolved. Learning in

a community is intimately tied and inextricably woven from the context in which knowledge is born.

This underscores the importance of considering real activities and situations when attempting to extend human thought through the provision of electronic learning resources. Straightforward declarative and procedural knowledge is relatively useless if context is not stated. If knowledge is to be re-purposed in a community or organization, the generative activities that produce knowledge must be contextualized in on-line storage to enable cross referencing of current activity to the historical endeavors of the community. Reflexive activity involving contextualizing knowledge must be fostered in a community to generate strategy building. Tools that enable people to contextualize the activities that give birth to knowledge are a fundamental component of the Electronic Learning Community.

c) The Case is the Context

According to Spiro and Jehng (1990) and Spiro *et al.* (1991), it is essential to adopt a case and tool centered approach to the design of knowledge in ill-structured domains. They argue that helping learners represent knowledge from numerous and diverse contextual perspectives, facilitates the construction of new representations and solutions in the face of novel problems. Learning processes of this kind indicate 'cognitive flexibility' (Spiro et al., 1991). Cognitive flexibility theory emphasizes learners bringing numerous knowledge structures together in an instance to create a novel solution to a problem at hand.

Spiro *et al.*, (1991) argue that to acquire knowledge successfully in ill-structured domains, learners must be exposed to, and revisit, materials in many contexts. On a first pass through novel information, learners make certain links with pre-existing knowledge based on the context of presentation. Future encounters with contextualized information

(knowledge) generates flexible knowledge representations and structures in learners. This enables the creation of criss-crossed landscapes of knowledge, a comprehensive and holistic understanding of a knowledge domain. In turn, a learner's ability to appropriately analyse and assess future experience capitalizing on a large breadth of contextual understanding is enhanced. The more knowledge is presented in a variety of contexts, the more alternatives exist in the face of new experience. Research indicates that practice in a variety of contexts also improves retention, leading to a greater spread of activation, hence facilitating retrieval (Lajoie, 1993).

Spiro and Jehng (1990) call for a fundamental unit of instruction called the 'mini-case'. "Mini Cases' are segments drawn from a larger case that represent smaller pieces of the organization or community's big pie. The logic behind case exploration is that the more cases a learner explores, the more dynamically they will be able to apply knowledge in the future. For Spiro and Jehng (1990) a major advantage of adopting a case centered approach is that learners avoid problems associated with oversimplification. Additionally, cases can help scaffold learners through the process of understanding the complexity of the larger picture, making precedence an available commodity. The case is the context..

According to Tierney (1997) case-based reasoning (CBR) can in fact be used as an overriding framework for managing, accessing and sharing knowledge. His vision of the use of case-based reasoning for knowledge management entails fostering intuitive dialog that takes users through a set of Q&A iterations to isolate or locate experiential knowledge. Locating knowledge involves supplying a set of criteria for a search in the form of a natural language expression, stating a question or problem. The system then searches and retrieves cases that are the best matches to the specified criteria. Like cognitive flexibility, the idea is to provide a variety of similar cases to create a more elaborate web-like understanding of the issue. Tierney emphasizes the cyclical, iterative nature of this process; learners find and

collect knowledge and best practices in the form of cases, they re-use and re-purpose these cases in confronting a novel situation and thus they create new cases.

3. What is meant here by Community?

The sociological definition of community at a root level is that the experience of people and their understanding of their community resides in their orientation towards, and perception of, its shared symbols (Cohen, 1985). Shared symbols unite a community and allow its members to understand and make sense of things similarly. Socialization into a community implies that people acquire communal symbols and in turn use them in social situations to negotiate meaning and come to understanding. In the case of the Electronic Learning Community, if a definition of learning is derived from a socio-cultural approach and is coupled with 'electronic' information and tools, the environment in which knowledge is exchanged, contextualized, and constructed is the community regardless of temporal factors. Symbols in the Electronic Learning Community exist in both face-to-face and distance realms. The discussion of community, and by extension symbols, presented here is primarily concerned with electronic communities and symbols and thus communities that exist at a distance.

What kind of assumptions does one make about delivering a community's knowledge-base? The underlying assumption in answering this question must be to look at how meaning is negotiated within the community of users. Clancey (1997) makes the argument that the first step in developing tools that encourage participatory activity is to give thought to delivering a community's knowledge-base. How do learners discuss, argue and come to understanding within their community? What knowledge do they employ to meet their collective goals? Following Vygotsky (1978), the social negotiation of meaning in a learning community is rooted in the utterance and evaluation of arguments. It follows

that participation in discourse serves as the basis for the notion of community presented here. The underlying idea in fostering community in the Electronic Learning Community is to help individuals generate insight into how their use of knowledge and participation in its creation enhance the activities of the community as a whole.

a) Transactions

Any discussion of sharing knowledge in a community or organization gives rise to the question of motivation. How can people in a community be motivated to participate in sharing rather than hoarding knowledge? In order for a community to evolve, the motivation to share knowledge must be intimately tied to the extent to which individuals understand how their activities and contributions facilitate and perpetuate the overall evolution / functioning / operations of the entity.

How do you foster knowledge transactions? It all starts with leadership by example. Individuals must be empowered to manage knowledge. Today, managers in organizations must embrace the idea of being knowledge mediators. This implies managing knowledge, understanding how it is used in the organization and demonstrating the rewards that can be achieved when it is contextualized for re-use. Individuals must take charge and empower themselves to actively manage the creation and closure of the knowledge they create and utilize. The idea that knowledge can be recycled to facilitate day-to-day activity must be perpetuated. This suggests that if knowledge is to optimally evolve in a community, the rewards for sharing it must be implicit in activity.

Boyd (1997) suggests a barter / voucher system that rewards individuals for "high-quality relevant attention-time" (pp. 4) spent in providing assistance through learning conversations. The more quality time one devotes to sharing knowledge, the more quality

knowledge one can solicit from others via a 'requests-to-offers' brokering mechanism. "For this potential synergy to be actualized requires that participants should have confidence that their help-offerings will be reciprocated by suitable help from others. It also requires a trusted means to check up on reciprocal commitments promised, and an agency to monitor and report the quality of the actual learning-conversation tutorials held" (Boyd, 1997. pp. 1).

Reciprocal commitment is a key notion here. Overall, if knowledge is to be effectively shared in a discursive community, the reciprocal commitment to share knowledge must be undeniable. This requires that individuals be empowered to seek closure with the knowledge they generate, to equip knowledge via contextualization mechanisms for re-use. For Boyd (1997) the contextualization mechanism is the request for or offer of assistance and the ensuing learning conversation.

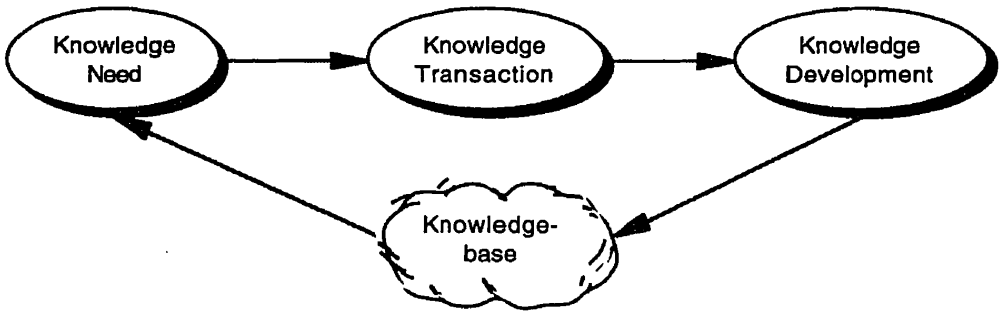

Figure 3: The iterative loop of knowledge transactions

The motivation to share knowledge must become an implicit part of activity and must manifest itself explicitly via return-on-time. Individuals must realize the fruits of their contributions in recognizing the utility of the contributions of others. The key to motivating individuals to engage in knowledge transactions in a community is to foster a belief in the

advantages of a reciprocal commitment to sharing and to demonstrate the efficiencies it affords via measures of return-on-time.

II. The Electronic Learning Community: A Framework

A. Introduction

This framework is not intended to be used as a prescriptive series of steps which specify every detail of the process of creating an Electronic Learning Community. Rather, it is meant to provide a basis for approaching the design and development of such a system taking to heart the idioms and issues raised in the first section of this work. Due to the fact that different organizations and communities have different needs and available resources and the wide range of potential applications of the framework, the precise choice of methods, sequence, tools and approach must be left to those empowered to implement a comprehensive learning solution.

Overall, the goal of developing an Electronic Learning Community is to empower individuals to define their conceptions dynamically, utilizing organizational memory to collaborate around and effectuate processes, procedures and decision-making. An Electronic Learning Community (ELC) should address the tacit aspects of knowledge, that is, the coordination and choreography of information which drives the formation, evolution and practical application of socially constructed knowledge (Clancey, 1997). The ELC should attempt to be an "intelligent infostructure" (Rappaport, 1997), allowing for the rapid customization of learning materials in re-using and re-purposing socially constructed knowledge and learning resources.

1. Designing the ELC: Phases of Development

From a holistic perspective, the framework takes a two phase approach to designing and developing an Electronic Learning Community. The first phase of development is the design of the heart of the Electronic Learning Community; a knowledge gathering phase with an aim to the development of a foundational 'database of knowledge'. Laying the foundations for a database of knowledge involves centralizing the target group's knowledge; amassing, amalgamating, indexing, and contextualizing as much of the group's media assets and procedural and conceptual knowledge as possible. The goal of phase one is to lay a foundation on which future knowledge will grow and around which interaction will occur.

The creation of the foundational database of knowledge drives phase two which involves assessing and implementing specific technologies to satisfy learning needs. This phase is marked by the consideration of tools and technologies that can drive the Electronic Learning Community's evolution. The learning and information needs identified in phase one and other needs assessments should be the basis from which decisions on the implementation of specific learning and communication technologies are made. This is why the consideration of technology is left to phase two of the framework. The idea is that the development of the database of knowledge steers the implementation of the technological solution.

It is the contention of this thesis that it is impossible to ascertain the efficiency, effectiveness or appropriateness of learning interventions without understanding the breadth, depth and accessibility of knowledge utilized by the entity. Needs assessment must underscore learning interventions (Smith & Ragan, 1993). Learning and information

needs are inextricably intertwined, both must be considered in any needs assessment attempting to identify electronic learning interventions.

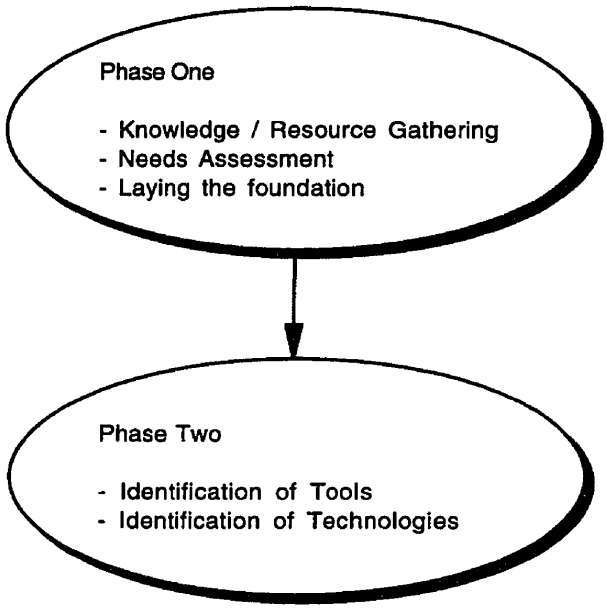

Figure 4: Phases of Development

B. Phase One: Gathering Knowledge for Re-use

The Electronic Learning Community argues for an approach that takes root in the idea of the Learning Organization (Senge, 1990; Argyris, 1992; Watkins & Marsick, 1993; Garvin, 1992; Ulrich, Jick, & Von Glinow, 93; Isaacs, 93) with particular emphasis on the idea of organizational memory (Walsh & Ungson, 1991; Levitt & March, 1988; Huber, 1991; Ackermann & Malone, 1990).The goal of the Electronic Learning Community is to create an intuitive knowledge-based environment where the activities of individuals drive the evolution of the entity's memory and practice. One of the keys to the creation of the Electronic Learning Community is the construction and re-use of information and media

assets stored in databases of knowledge. The database of knowledge represents a partial objectification of organizational memory.

1. Organizational Memory

Organizational memory can best be described as the conceptual, procedural and contextual artifacts produced by organizations and their consequences on active individual and organizational performance (Senge, 1990). The effectiveness of organizational memory on both individual and group learning and performance is best evaluated through an examination of access and distribution. Can individuals in the organization or community identify and utilize organizational knowledge in performance situations? One of the benchmarks in assessing the success of a learning organization is to ascertain the pervasiveness and distribution of its memory.

Koulopoulos (1997) emphasizes that internal and external awareness and responsiveness are required at all levels of an organization if it is to achieve what he has dubbed 'corporate instinct'. Corporate instinct speaks to the effective distribution and use of knowledge. The idea of 'corporate instinct', or the intuitiveness with which an organization can adapt to its internal and external environments, is applicable to all types of entities united by a shared database of knowledge. Internal awareness implies that the entity (community or organization) understands itself and by extension can execute responsive change internally in any number of adaptive ways, including knowledge sharing across units. External awareness implies that the entity understands how it is perceived based on external environmental conditions and cues. By extension the entity can readily identify responsive external changes. At the core, the idea of internal and external awareness and responsiveness implies that an entity successfully manages its organizational memory.

One of the keys to managing organizational memory involves validating knowledge in terms of its certainty and reliability. The idea that individuals are responsible for explicitly assessing the certainty and reliability of knowledge represents the radical redefinition that the learning organization implies for people, especially those who fall into the general category of 'managers'. 'Managing' in today's learning organization means that one has to act as an agent of change, empowering individuals to document their knowledge and become decision-makers. Effective decision-making requires that the reliability, validity and certainty of knowledge used in reasoning has been established through some form of knowledge management. Managers must harvest and sow knowledge and empower and reward others for doing the same.

A particularly relevant attempt at managing the certainty and reliability of organizational memory was conceived and executed by Ackermann and Malone (1990) in their creation of 'Answer Garden', a database of frequently asked questions (FAQ). Answer Garden employs a branched question structure that is meant to lead people to the answers to the questions they posit. When no answer to a question exists in the database, the question is routed via e-mail to experts. Once they have addressed the question, both the question and answer are routed to the inquirer and are entered into the database. Experts maintain the Answer Garden system by managing the database of knowledge. Questions that are ambiguous or redundant are revised or eliminated and unused sections of the FAQ are deleted. Ackermann and Malone's approach suggests how conferencing systems tied to flexible databases of knowledge that incorporate novel ways of organizing and displaying information have the ability to ensure the certainty and reliability of knowledge.

Ascertaining the certainty and reliability of knowledge, gets to the heart of the emphasis to be placed on gathering organizational memory in phase one of the development of the Electronic Learning Community. Knowledge resources are only as useful as the ease

with which they can be applied to problems in the future. Therefore redundant and ambiguous knowledge must be identified, revised and deleted. Employing this perspective can help regulate the depth and breadth of organizational memory collected both in the early stages of development of the database of knowledge as well in its future evolution.

2. The database of knowledge

The database of knowledge can belong to the organization or community as a whole or to its subgroups. Databases of knowledge contain information that has been contextualized into knowledge for re-use by other members of the subgroup, group or collective entity. When a database of knowledge is browsed, it is presented in the form of a document which may contain graphics, text, audio, video, hyperlinks or even simulations and VR worlds. The documents that a database of knowledge contains are virtual entities in that they do not remain static. They change with the collective evolution of the entity's organizational memory. The rate by which an organization or community can grow is distinctly marked by their ability to re-use and re-purpose extant knowledge (Koulopoulos, 1997).

Any discussion of a database of knowledge implies that a distinction be made between knowledge, information and data. For some, data has meaning and as such constitutes information. For others, data has no meaning and therefore acts strictly as noise generated by the system. A 'database of knowledge' provides the explicit demarcation of linkages between discrete pieces of information and media assets which constitute knowledge. A database of knowledge can also be defined as the mechanism by which the connections between information can be navigated, perused and re-used. An important distinction is made here between information and knowledge. Information is the raw facts

and figures of the organization or community, while knowledge is the context that ties information together.

Organizational memory within the database of knowledge can be broken down into two types of information, conceptual and procedural, and one broad classification scheme: contextual documents . Conceptual information is likened to declarative knowledge. These are the facts and figures available to the community. Information that is easily classified, indexed and can be re-purposed in multimedia-based training and just-in-time systems. Procedural information represents the processes of the community or organization, the method and sequence of activity. Both are constantly in flux in any community or organization.

Conceptual information on its own can be used to clarify meaning in providing definition. But on its own it remains declarative knowledge. Something that can only be spit back when a definition is required. Sometimes it is necessary in this form. Conceptual information can easily and effectively be re-purposed in electronic performance support (EPS) systems. EPS systems are electronic learning resources that allow individuals within an organization to access crucial conceptual information on the spot as required. These are systems that scaffold individuals in their endeavors by reducing the cognitive load associated with retrieval and retention. While these systems are quite effective at reducing the cognitive load associated with fulfilling a specific task, alone they represent but a small and isolated aspect of a comprehensive electronic learning solution.

The same can be said of performance support solutions that strictly engage procedural information. Procedural information on its own can be used to clarify process. This type of information can be re-purposed in applications that scaffold individuals through tasks, but alone it does not allow learners to become effective decision makers.

Employing procedural or conceptual information in electronic learning products assumes that humans operate like automatons, simply seeking definitions or engaging in step-by-step processes to achieve clearly defined ends. But we know that this is not what humans need in order to function in complex information environments. In order to thrive in these environments, over and above procedural and conceptual information, humans require the big picture, the context in which knowledge is applicable.

a) Laying the foundations

An important consideration in phase one of the development of the ELC is timing. Laying the foundational database of knowledge presents a set of challenges marked by the age of the organization or community as well as its size. There are no short-cuts to achieving cost-effective learning solutions. It is evident that large, established organizations need to invest a substantial amount of time and resources to develop a comprehensive foundational database of knowledge. On the other hand, organizations or communities in their infancy that adopt a knowledge-based approach have the potential to quickly emerge as true learning organizations. But for large organizations or communities, issues related to the breadth and depth of information and knowledge can present daunting challenges. An up-front investment of time and resources for a large organization means targeting key and smaller internal workgroups. A more manageable investment of up front time can be achieved by adopting a knowledge-based strategy at the onset of new endeavors or projects within smaller workgroups.

Regardless of the target group, from a holistic perspective the overarching strategy must be to effect a substantial change in the mindset of individuals contributing to the development of the database of knowledge. Sharing certain sets of knowledge must be encouraged while hoarding some types of knowledge must be discouraged. Rewards for

sharing must be established. By applying a knowledge-based strategy at the onset of new projects or endeavors, it is possible to demonstrate to individuals the rewards of knowledge sharing in a smaller closed system.

What makes for the success of embarking on a knowledge-based project? The most important thing to look for is a fit between knowledge management and the culture of the targeted group, generally looking to improve the overall climate and environment for knowledge sharing. Individuals may have an easier time understanding and gaining practice with these concepts in a microcosm of the larger entity, i.e. a defined knowledge-based project. If the environment of the target group is not receptive to the endeavor, a group that is within the entity that is receptive needs to be unearthed and worked with as a starting point. Skills developed in the microcosm of a specific knowledge-based endeavor can be transferred to the development of a larger overarching database of knowledge in the future.

Overall, the rewards of developing a database of knowledge in phase one should prove to be far more substantial than the fleeting and convoluted scaffolding afforded by expensive Band-Aids such as 'one-off CD-ROM solutions'. Any organization with a well-defined plan for building and maintaining an active database of knowledge has the potential to profit from a wide range of successive and successful implementations of cost-effective electronic learning solutions.

b) Gathering Resources

After targeting a specific workgroup, one of the keys to gathering resources is to define and prioritize objectives. In addition to defining how the database of knowledge is meant to support the community, the explicit statement and prioritization of objectives will also allow for an effective assessment of return-on investment. The key is to determine the

specific needs of the target group and state the nature of the implementation in terms of learning objectives. This will allow for the measurement of the return-on investment of the endeavor.

It must be emphasized again here that even when a smaller workgroup within an entity is targeted, it is essential to plan for the future. Realizing that the database of knowledge is ultimately for use by the organization or community as a whole is the key to successfully integrating knowledge at all levels of an entity.

The starting point in creating a foundational database of knowledge is to develop an in-depth understanding of the internal and external functioning of the targeted organization, workgroup or sub-group. Over and above all else there is the necessity of understanding how information in the organization facilitates decision-making, who uses it and how. Cybersystemic modeling (Wiener, 1948; Schoderbek, Schoderbek, Kefalas, 1990) can be used to map out and understand the complex interactions that occur around information sources in an organization. Once this assessment and understanding has been achieved, all primary and secondary learning and reference resources available in the target group should be identified and all parties with a vested interest should be solicited for contributions to the structure of the database of knowledge . Often times, specifically in the case of large organizations, there may be a need to bring in a third neutral party to facilitate this process. Employing a third party at this stage of development for a large organization provides the advantage of a fresh set of neutral eyes assessing information and learning needs.

Gathering information in the community or organization can be effectively achieved by examining workflow and decision-making processes. Examples of issues that should be addressed in the knowledge gathering phase include: understanding how specific information contributes to the decision-making process and understanding how information

gets to the people who really need it. As these issues are considered, the criteria for generating cases in the future will become more and more apparent.

It is essential that all members of the targeted entity contribute in the initial development of the database of knowledge. Individuals should be empowered in the initial definition and design of the database of knowledge in a quest to generate a case-based classification scheme that addresses their specific needs. This will empower them further down the line to utilize the system when they see that their needs have been addressed. Individuals should be petitioned based on their workflow. The goal is to eventually create a knowledge management system that is so deeply ingrained in workflow that it is virtually transparent. What happens when information technology and a 'reporting' mechanism are introduced into workflow in the automated technological approach?

An example of a generative and evolutionary knowledge-based system is StoryNet (Giordano, 1997). StoryNet was implemented in an undergraduate university course in information systems analysis and design at the University of Catania in Italy. Students in the course were required to produce a complete information systems design as well as develop a software prototype of one of its components. Each design created by a student is stored in StoryNet in the form of a 'story' as enhanced by component 'episodes'. Attached to stories and episodes are comments, links and multimedia documents that illustrate the context in which the data model has been implemented and has evolved based on precedence. Comments expand on design reasoning. Links denote precedent 'stories' that were used in design creation. And multimedia documents provide a visual illustration of the implemented data model (e.g. screen shots of the user interface).

The philosophy behind StoryNet is that there is inherent value not only in sharing designs but also in explicitly stating the justification for design decisions and subsequent

evolution. This serves as a means of illustrating useful design precedents to newcomers engaged in the task of creating information systems designs. Designs in StoryNet are linked in a hypertext network that highlights how design solutions have evolved. This allows newcomers to traverse the road of 'old' design cases to 'new' design cases seamlessly, illustrating the evolution of design principles. Results of trials employing StoryNet suggest that access to shared design memory can impact on the quality of student design output (Giordano, 1997).

c) Contextual Documents

Implementations like StoryNet illustrate the concept of contextual documents and point to the importance they can play in sustaining a learning community. Like StoryNet, contextual documents get to the heart of socially constructed knowledge. They convey the combination of conceptual and procedural information and the scenario which ties the knowledge together in context.

The question begs, how does a community identify contextual knowledge? The first step is to understand the problem space. What kind of information and skills are required to engage in the activity? Probing for cases that exist within the community and are considered 'seminal' is a good place to start.

A contextual document represents the demarcation of links between discrete pieces of conceptual and procedural information and media assets. Phase one is primarily concerned with the creation and establishment of Contextual Documents that are highly relevant and seminal to the activities of the targeted group. Contextual documents can equally be understood as cases that will continue to evolve and give birth to new cases through future use of the database of knowledge.

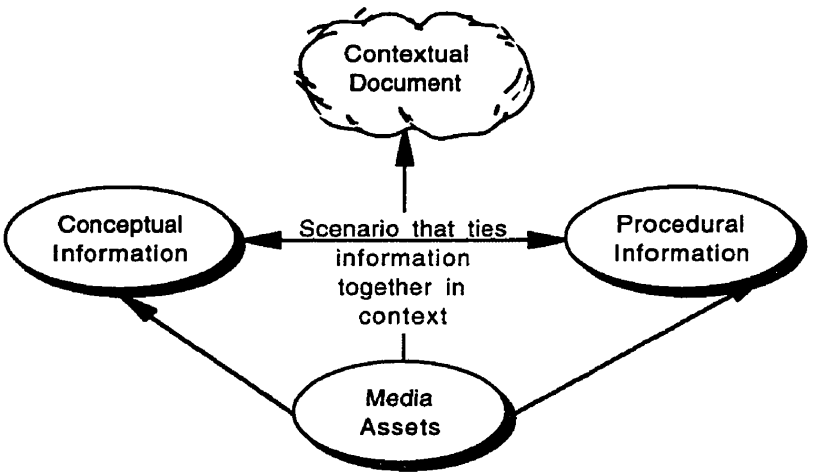

Figure 5: Contextual Documents

The idea of contextual documents follows the situated approach to learning whereby knowledge evolves in context and activity. In order for knowledge to be re-applied in both just-in-time and other multimedia-based training applications in the future, the context in which knowledge is generated and evolves must be explicitly documented in the form of a contextual document. Combining procedural and conceptual information into contextual documents in phase one requires the documentation and explicit statement of the specific factors and variables which led to the development of knowledge. This is equally applicable to the future evolution of the database of knowledge in practice.

Phase One necessarily involves amassing organizational / communal knowledge and media assets. It is important to emphasize that procedural and conceptual information input into the database of knowledge in phase one of development is NOT written in stone. Again, the knowledge gathering performed in phase one represents the building blocks or foundations of the ELC, the database of knowledge. The whole point of creating a knowledge-based learning community is to accommodate for the rapid rate at which

knowledge evolves and changes. By extension, the contents of the database of knowledge built up in phase one will subsequently be negotiated and will change and evolve in the hands of the community. The key to adopting a knowledge-based strategy is to recognize that knowledge is constantly in flux. Therefore any classification scheme, including what the Electronic Learning Community refers to as contextual documents, must evolve and accommodate new collaboratively developed knowledge structures.

3. Two Contexts

It is the contention of this thesis that there are generic applications for this framework across radically different organizations and communities. Therefore, in presenting the framework for the Electronic Learning Community, two different contexts of its application will be explored. The first context involves the design and development of an ELC for a software company specializing in the production of point-of-purchase expert systems. The knowledge and needs of this modern organization will be explored in order to elucidate the Electronic Learning Community framework.

The second context involves the design and development of communities interested in leveraging broadcast content as a means of developing knowledge through interactive discourse. This context involves the creation of media-based virtual communities that center around themes identified in broadcast content. A prototype of this system is currently being developed and is known as 'TrailBlazer'. It allows people to easily add, connect and link their own text, audio, graphics, and/or video to the contents of an on-line media database. This is a concept developed by the author, and currently in production. A good example of a 'TrailBlazer' community would be a sports community that re-uses pieces of broadcast content in communication, building community through media discourse. 'TrailBlazer' represents a method for expressing ideas about issues raised in broadcast content.

The presentation of these two disparate contexts throughout the rest of this thesis is meant to demonstrate the wide range of potential applications of the Electronic Learning Community framework.

4. Practical Applications of databases of knowledge and Organizational Memory

In order to elucidate the concept of contextual documents from a practical perspective let us look at the first context, the software company that produces point-of-purchase expert systems and the specific needs of their salesforce. Within this organization, the salesforce is required to apply conceptual information in a wide variety of procedural situations. While the proprietary point-of-purchase expert system that the company has developed is based on relatively stable conceptual information, the development needs of specific clients are rarely the same. This requires the salesforce to apply both conceptual and procedural information dynamically to a wide variety of scenarios when dealing with potential clients.

For instance, the salesperson must be able identify the compatibility of their own software with the existing electronic infrastructure of the client. This requires the salesperson to marry conceptual information (electronic hardware, compatibility, prices, specifications), with procedural information (what is required to implement the point-of-sales system into the existing infrastructure) in an attempt to demonstrate to the client the feasibility and cost of implementation. While every sales endeavor is different there are commonalties between past implementations and future sales. This is where contextual documents take root and have the potential to generate a cleaner sale.

What if the salesperson could access past cases of sales, in the form of contextual documents before writing a proposal? Perusing similar cases, according to established criteria, allows the salesperson to understand the context of the sale within the framework of the organization's memory. This allows the salesperson to adapt old cases in confronting new demands and situations. Precedence becomes a readily available commodity. Perhaps the salesperson finds a starting point for tackling the endeavor or sees that an implementation problem can be rectified in a manner s/he was unaware of, or returns to a certain case when writing a contract to re-purpose a legal disclaimer. Contextual documents open the door to re-purposing knowledge ubiquitously in day-to-day activity.

A simple example of a tool designed to help contextualize the generative development of knowledge in writing sales contracts would be a paragraph parsing tool presented as an option on saving a text document. This tool would simply allow someone to attach a keyword(s) or a marker to a paragraph denoting its context i.e. the legal disclaimer of a potential sales contract can be tagged 'legal disclaimer'. The contextual chain can further be established through the document's name and type. On a sales contract, the contextual chain becomes 'sales contract - legal disclaimer'. On saving a document for the first time a simple prompt can help contextualize the document within a larger system i.e. 'retail outlet - sales contract - legal disclaimer'. This not only demonstrates the type of information that must be documented as knowledge is generated in the future but also underlies the task of gathering and creating contextual documents in phase one of the process of developing the Electronic Learning Community.

5. Media Assets

All of the preceding idioms related to gathering and indexing organizational knowledge can equally be applied to the task of gathering media resources in Phase One of

the development of the Electronic Learning Community. Like knowledge, media resources need to be broken down into their component parts and indexed for database storage. It is essential that community members be involved in assessing the importance or lack thereof of media assets in the knowledge gathering phase. Individuals should examine all media assets from graphics to video to multimedia training products, extracting and indexing salient ingredients. It is important to remember that the development of a media classification scheme for the database of knowledge must accommodate the community as a whole. Media assets which are essential to one sub-group of a community can be useful to others and, while they may seldom access them, their value may be significant given a novel situation. Therefore, the classification scheme developed must be decipherable by all members and groups of the community.

C. Phase Two - Tools and Technologies

At a base level, the underlying technology that drives the Electronic Learning Community is computer-mediated communication. Computer-mediated communication allows individuals to become active discussants within a community by providing them with a continuous forum that defies time and space. While synchronous communication is a part of the framework for the Electronic Learning Community, there is no denying that asynchronous communication is its backbone. Asynchronous conferencing is the engine that drives community immersion, by providing a reflective and fertile forum that enables growth, evolution and the representation of shared knowledge structures through active discourse.

Fundamental to phase two and the successive development of the Electronic Learning Community is the utilization of tools and methods that allow individuals or workgroups within an organization to easily state and identify the context in which

knowledge is born. At the core, contextual knowledge represents the links between conceptual and procedural information, understanding, communicating, contextualizing and doing. Contextual knowledge exists in a database of knowledge in terms of the links it draws between discrete pieces of conceptual and procedural information and knowledge assets.

The idea of computer-mediated communication coupled with the regional and global pipelines that are our networks has brought us to a level where we are able to begin to explore the potential of synchronous and asynchronous multi-dimensional learning. While bandwidth varies based on geographical locale and available connections, we have currently achieved a sufficient base level of electronic communication potential to cement the foundations for an Electronic Learning Community (ELC) even at low bandwidth connections (28.8 kbps). The Electronic component of the ELC, the technology, encompasses that which can be achieved by combining the power of distributed information systems with computer-mediated tools and communication devices that foster, develop and maintain learning communities.

Asynchronous communication in the form of computer-mediated communication and computer conferencing (Jonassen et al., 1995; Harasim, 1993; Boyd, 1990; Willis, 1991; Dicks, 1992) has long been recognized as an extremely effective method of facilitating discourse and conversation and by extension, learning. But only a handful of communities and organizations today are taking asynchronous communication to the next level by fostering discourse and decision-making around shared knowledge and media libraries. What becomes of a discourse community when they can access and leverage knowledge, media and content of any kind in conversation? Understanding on-line discourse and conversation requires an examination of the essence of interactivity.

1. Defining Interactivity

To define interactivity in relation to the Electronic Learning Community, the idea of re-using and re-purposing knowledge / content in a community or organization will be explored as related to the second context: TrailBlazer.

a) Browsing

Do we interact with traditional broadcasts such as radio, film or television? Hardly. Sitting down in a theatre or on the couch, we listen to radio and view films and video. But can we interact with broadcast content on-line? The answer is yes; but not in terms of viewing. When we view, we don't interact. But we do take a step closer given our ability to browse. Browsing broadcast content is radically different from viewing it. Broadcast content that is stored and indexed in on-line databases can be browsed non-linearly, in any order.

Why browse broadcast content on-line? Chances are if we're interested in the content we would have already viewed, read or listened to it in its entirety, linearly. But there are always those elements that piqued our interest, amused us or helped generate an idea, question or thought. Small pieces of the whole that have meaning outside of the strict context of the broadcast - elements that can be juxtaposed with elements from other broadcasts as well as our own thoughts and ideas in the creation of new contexts. The options for browsing broadcast content become endless when it is deconstructed, indexed and database technology is employed. Browsing is the first stepping stone towards interactivity. Constructing and expressing thought is the next.

b) Constructing

The construction of ideas, the expression and utterance of thought, semantics, discourse and language is where the idea of TrailBlazer takes root. In terms of broadcast content, tools developed for an Electronic Learning Community can facilitate the construction and expression of media utterances, allowing people to combine pieces of broadcast and print content in expressing thoughts related to browsing, viewing, learning and living in general. Through the use of the right tools like TrailBlazer, the Electronic Learning Community can enable people to express a multimedia vision of their ideas by facilitating the construction of media pathways. Pathways consist of pieces of broadcast content linked together by the text, audio and/or video of individuals.

TrailBlazer allows individuals to represent the full landscape of their thoughts in and around broadcast content, from inception and influence, to elaboration, justification and conclusion. The idea that people can express ideas and thoughts by employing broadcast and print content and generate knowledge collaboratively as a community gets to the heart of the notions of interaction and community that the Electronic Learning Community defines.

c) Interacting

Once the conditions of 'browsing' and 'constructing' have been met, we have the possibility for true interactivity. While 'browsing' and 'constructing' are implicit in interactive engagement, alone they do not constitute interactivity. Interactivity implies conversation and discourse and on a greater level, community. What purpose does a blazed trail serve if it cannot be examined by others, leading them to new places, to new ideas, and uniting them as a community?

When we browse and construct we engage ourselves and our thoughts. When we interact, we engage our thoughts and the thoughts of others in discourse and conversation. But what happens when we add knowledge libraries of all kinds, including broadcast content, to on-line discourse and conversation? Companies like Hewlett-Packard and Xerox PARC have created vast communities of users collaborating around an evolving knowledge library and have demonstrated tremendous rewards in the form of return-on-investment (Tierney, 1997). Tierney suggests that in order to perpetuate knowledge management in an organization, a series of 'rigorous processes' must be designed that hold knowledge management to the same standards as other organizational implementations. This requires the specification of organizational objectives tied to measurable return-on-investment metrics. Examples of return-on-investment measures for knowledge management initiatives include reducing technical support calls, cutting down technical support call time, decreasing time on task, increasing speed, reducing cost, and decreasing redundancy.

2. Exploratory Structure

It is important to keep in mind that decisions related to the implementation of tools and technologies can be made at any time throughout the evolution of the ELC. The major benefit of developing a database of knowledge is its scaleability. Because knowledge is centralized in one place, the return-on-time of initiating educational implementations (i.e. tools and technologies) at anytime is significantly increased. So what kind of tools and technologies can be used to work with an organization's database of knowledge? They can be reduced to four general categories: Multimedia-based training (including CBT, and scenario-based training), Performance Support Systems (including Just-In-Time support systems), Presentation Builders (including PowerPoint, Authorware, FrontPage; and other authoring systems for laypeople), and Desktops (including push technologies). Push

technologies are systems that are designed to present users with up-to-date information without the user generating a request for said information. These systems generally employ 'agent' technology. Agents peruse databases of knowledge to ascertain whether or not new information related to a specific domain has been generated of which the user is not yet aware. Once new information has been identified by the agent, the system 'pushes' the data directly to the user's browser or desktop based on specified preferences.

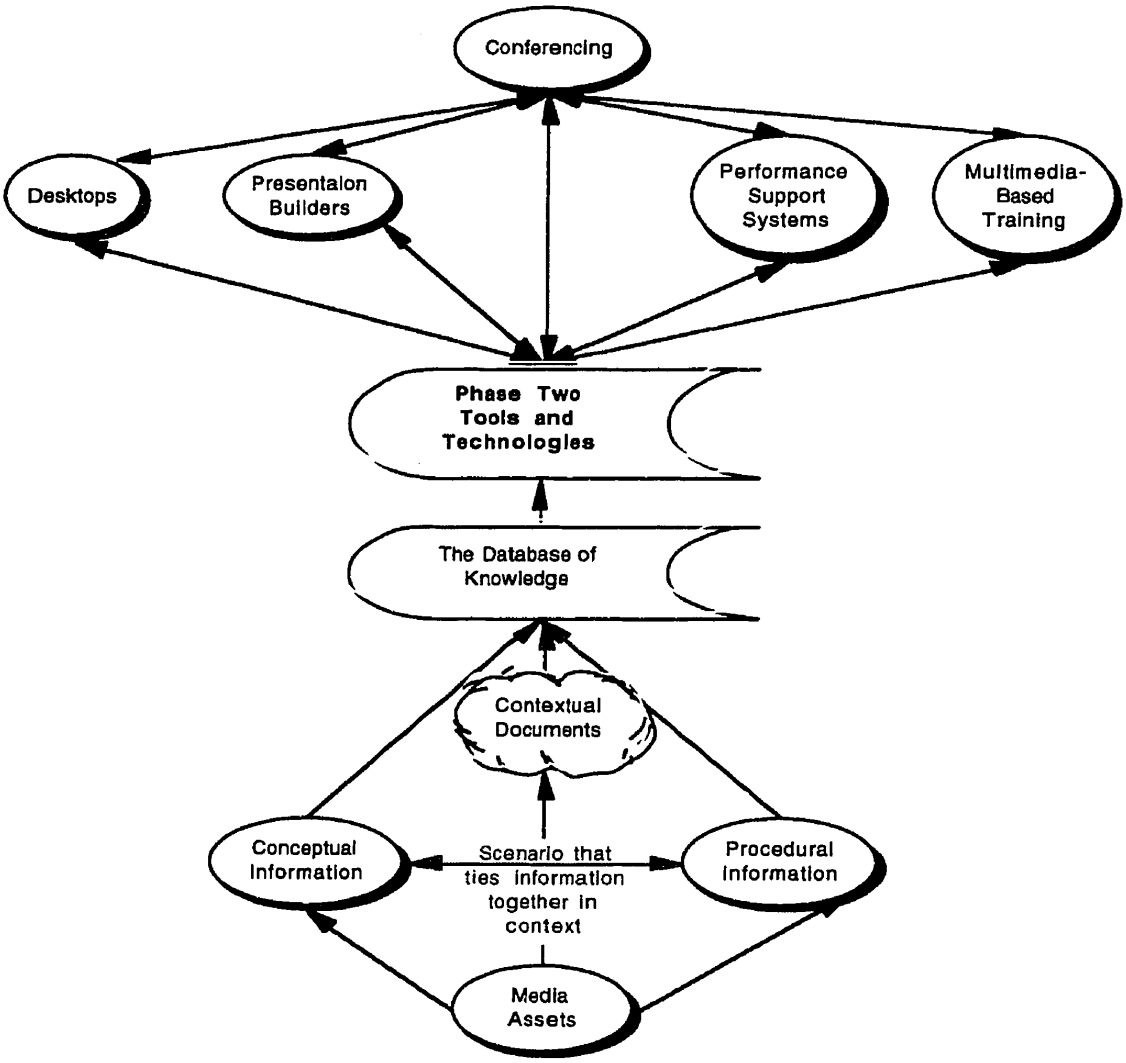

Figure 6: The ELC - Phase Two

How can tools facilitate the creation of contextual documents? What kind of tools can be employed that allow individuals in a community or organization to produce, modify and utilize context specific multimedia and scenario based training as their needs arise? These are the types of questions that need to be addressed once the foundational database of knowledge has been created and when initiating any other technological learning intervention. The structure for exploring the four broad categories of tools and technologies is based on the following heuristics which serve as a basis for discussion:

- *Leverage the database of knowledge*: The multimedia 'database of knowledge' is the core of the Electronic Learning Community. It not only powers the design, development and creation of context specific multimedia training documents, but can also be used within the shared conferencing structure to assess and identify trends and needs by all of players cooperating in and around the organization. What does it take to maintain a knowledge-based system that enables the re-purpose and re-use of knowledge produced at all levels of a community given the use of a specific technology? What effects does the implementation of a specific technology have on the maintenance of the database of knowledge? How can the contents of a community's database of knowledge be leveraged using a specific form of technology? These are some of the issues that will be raised in exploring tools and technologies.

- *Think context*:: How can knowledge that has been produced in the past be used in the future to effectuate tasks across a broad range? How can we facilitate the contextualization of knowledge by individuals in the community or organization given the presence of a specific technology? The idea is to foster the documentation of knowledge used in day-to-day activity as it fits into the organization's big picture and how this knowledge can be re-purposed across workgroups. From tools that address

and satisfy context specific learning needs to tools that specify detail in supporting communication activity, life becomes a whole lot easier when you can compare, re-use and recombine knowledge from past and present experience. Tools developed for the Electronic Learning Community must support the user in the active contextualization of knowledge.

- *Conferencing*: Why must a community's knowledge be tied and woven into conferencing activities? How can all forms of conferencing (audio, text, video) be enhanced by the injection of context specific knowledge from the database of knowledge? How can this knowledge be used in conferencing to not only support work flow but to identify learning needs, goals, and future directions?

3. Multimedia-Based Training

The term multimedia-based training (MBT) is meant to refer to implementations that familiarize individuals with conceptual or procedural best practice. Multimedia-based training combines media assets such as animations, videos, audio clips, simulations, tests or questionnaires with content that is traversed linearly or non-linearly by users. The difference between multimedia-based training in the Electronic Learning Community and the electronic learning products referred to earlier is that multimedia-based training in the ELC harnesses the database of knowledge to deliver training that is up-to-date, certain and reliable. Creating MBT documents in the Electronic Learning Community means using tools and technologies that allow individuals in the entity to harness the database of knowledge in constructing and browsing content.

a) Leverage the database of knowledge

Multimedia-based training is most effective when it is used to familiarize individuals with new concepts, projects, or ideas in which they are becoming involved. It is best to look at multimedia-based training as a method of imparting the big-picture to people. Therefore, the best cases to work with in delivering a MBT document are those that represent the whole. MBT is most effective because of its support for the hierarchical classification of knowledge. Cases that represent the big picture are therefore useful because they can be broken down into branches that can be explored linearly by novices to the content and non-linearly by those familiar with the domain.

Simple tools (David et al, 1997) can be used by community managers to input knowledge and media assets form the database of knowledge into templates as learning needs arise. With respect to the first context presented, the point-of purchase expert system software developers, knowledge managers working in the technical support department organize knowledge assets in templates used in the training of new employees. The benefit of using a knowledge-based system here is that the new employee is able to become familiar with the most recent cases that epitomize the most pressing technical support needs of their clients at that particular time. If they employ an electronic learning product in this instance, they would have to take time before or after the MBT document was utilized to explain differences between the needs of the department then and now.

b) Think Context

Creating MBT documents means that people browse and construct. The benefit of placing tools that allow for the construction of MBT documents into the hands of knowledge managers in a community is that they best understand the context in which

procedural and conceptual knowledge should be presented. They understand how the need for knowledge arises and how it can be employed to effectuate a decision or task. But the responsibility for contextualizing knowledge into cases has to filter down to other members of the community or organization as well. This re-emphasizes the need to provide tools like paragraph parsers down the lines so that knowledge can be effectively utilized when a manager constructs an MBT document.

Knowledge managers in the technical support department of the software company construct MBT documents to train new support employees that are structured on the following hierarchy; client type is broken down into software system (from a suite of inventory control products to specific sourcing tools) which are broken down by feature. This company deals with the creation of customized systems to meet the specific needs of their clients. Therefore they decided to create an MBT template which breaks knowledge down first by client and then by system and feature. The rationale was that cases were best understood holistically based on the needs of their clients first and the functionality of the software second. This is reflected in the overall indexing system of the database of knowledge as a whole as well. The largest efficiency achieved in empowering the knowledge manager to construct MBT documents is that the technical support person that they are training is always made familiar with the most recent client implementation. This is what the majority of their calls will be about.

c) Conferencing

Conferencing can be tied to the use of MBT documents by fostering discourse related to their content. New ideas presented in the form of MBT documents and passed between members of a community as a means of justifying or elaborating upon an issue can be discussed effectively using computer-mediated communication. Any issues that are not

addressed in the MBT document or cannot be discussed face-to-face can be addressed using conferencing systems.

4. Performance Support Systems

Performance-Support Systems (PSS) allow individuals to access specific conceptual or procedural knowledge in the midst of being engaged in an activity. An example of a PSS is used by the technical support department of the software company. Support people can access specific information related to all of the features of the company's software as well as procedural information related to troubleshooting in specific systems. Information in their PSS is indexed by client, software and feature.

a) Leverage the database of knowledge

The benefit of using a database of knowledge when employing a PSS is that information that is delivered reflects the day-to-day development of organizational or communal knowledge. As conceptual and procedural knowledge evolves, the content of the PSS changes. Again, the PSS employed in the Electronic Learning Community is merely a template that harnesses the contents of the database of knowledge. The effective use of PSS systems rehashes the need for an organizational or communal commitment to knowledge management.

b) Think Context

Paradoxically, a PSS is the antithesis of the sermon that the Electronic Learning Community preaches. A PSS contains information. The distinction between knowledge and information is rehashed here. A PSS contains procedural and conceptual information

existing outside of context. The idea is that the PSS scaffolds the user, unburdening them from the cognitive load of remembering specific details. A PSS is used in activity. Therefore the context which dictates and guides its use is that which is occurring in the moment. And it has been demonstrated time and again that when context can be established, the use of a PSS can be tremendously effective (Lajoie, 1993).

c) Conferencing

In conferencing activity, performance-support systems can be used to enhance the nature of communication. Accurate and reliable conceptual knowledge is always an asset in communication. To be able to leverage it from an evolving database of knowledge through a performance support system in communication can reap tremendous rewards for an organization. The software company's technical support department personnel frequently respond to email queries by re-using generic responses to generic questions from their database of knowledge. Often times, a specific query can be addressed simply by changing a line or two in a generic response providing a solid return-on-time for query responses.

5. Presentation Builders

The best example of this class of tools and technologies is presentation building software such as PowerPoint. In organizations and communities that do not adopt a knowledge-based approach, when the need arises to create an internal or external presentation of knowledge, individuals must begin from ground zero in constructing documents. In the Electronic Learning Community past presentations made by other members of the community can be harnessed from the database of knowledge and enhanced and tweaked to meet current presentation needs.

a) Leverage the database of knowledge

Evidently, the database of knowledge affords tremendous rewards here. Being able to peruse different cases that demonstrate different approaches to similar presentation needs allows individuals to identify and re-purpose successful elements of past presentations to meet current needs. In the software company, past presentations are contained in the form of cases in the database of knowledge. These cases are directed towards their salesforce who make the majority of external presentations to potential clients. When the need to make a presentation arises, the salesforce can peruse past cases that involved similar implementations and re-purpose specific aspects of these presentations into their current documents. This saves them time on numerous counts. Firstly, work that has been done gathering specific information that addresses specific client needs can be re-used seamlessly. Secondly, variables that may affect the potential sale that other salespeople have understood to be factors for success are indicated from the outset, leaving less room for omissions in the presentation. Lastly, individuals do not have to start from ground zero when initiating a presentation. They have solid grounding on which to begin their efforts.

b) Think Context

This discussion of presentation builders again highlights the necessity of contextualizing knowledge that is generated in the community or organization into a case-based format. In order for individuals to be able to re-purpose past presentations, the context in which the presentation was made must be explicitly defined in the database of knowledge. In the context of the software company, this requires that past presentations be contextualized according to client type, client needs, implementation factors, budget,

software type and software features. This allows for a comparison of past cases that deal with specific issues related to current presentation needs.

c) Conferencing

Conferencing can be used around presentations that have been constructed to facilitate a number of organizational or communal activities. Presentations that are newly created using the database of knowledge can be discussed on-line via conferencing software. Additionally, past presentations can be discussed in order to isolate the contextual factors that classify them into the greater scheme of client needs and solutions.

6. Desktops

More and more, organizations and communities are beginning to understand the power of the desktop from a collaborative as opposed to individual perspective. Desktops today not only facilitate the efficient, effective and appropriate satisfaction of individual tasks and goals but also can be used to address and satisfy the collective needs of the entity. Push technologies are a particularly effective technology related to desktops. Push technologies can be used to proactively alert individuals when new relevant knowledge is created in the database of knowledge. Push technologies can be used to assist individuals in customizing and focusing the emphasis they place on employing and generating knowledge in their community or organization. In the software company, the technical support department uses 'push' technology to alert their support staff when changes to procedural or conceptual knowledge occur. Alerting support individuals that knowledge has evolved allows them to constantly provide their clients with the most up-to-date best practice for troubleshooting.

a) Leverage the database of knowledge

Obviously the database of knowledge is the key ingredient in the mix of desktops and push technologies. Using push technologies allows individuals to constantly be aware of changes in organizational memory that impact their day-to-day routines. But how can knowledge that is generated on desktops or received in paper-based format from clients be easily transferred to the database of knowledge? Recently Xerox has come up with a novel solution to this problem. Slowly but surely, Xerox is turning the photocopier into the knowledge centre of the organization. Xerox photocopiers today can not only receive documents from the desktop for printing and copying, but they can also scan documents using optical character recognition software and pass them back to the desktop. This means that not only the knowledge that is generated on desktops can be classified in the database of knowledge, but also paper-based documents that are received from external parties. The idea of employing optical character recognition technology to facilitate workflow is not new, but Xerox's initiatives are making its use ubiquitous and transparent.

b) Think Context

Having the ability to take paper-based documents and incorporate them into the database of knowledge goes a long way towards facilitating the contextualization of cases. This allows individuals to take even the most minute piece of correspondence and incorporate it into their case to enrich the quality of their contextualization activities. People can demonstrate successful or unsuccessful interactions with external parties to the other members of the community to be used in the future when deciding on potential courses of action. Additionally, organizations or communities can inject knowledge that exists outside

of their realm into their database of knowledge to provide a more comprehensive understanding of the environment in which they operate.

c) Conferencing

Conferencing activities that take place on the desktop and beyond can be considered to be knowledge assets that can be re-purposed and re-used in organizational or communal activity. The key is to making individuals in the community aware of the value of said resources. Communication that occurs in and around the organization or community can be of tremendous value if it is identified as such. The problem is that there is such a wide breadth of communication content that is generated in an organization that it is difficult to identify that which is of great value. The responsibility and onus for identifying communication knowledge that is valuable in elaborating on context must be left to individuals in the community who generate or receive the communication. Knowledge managers must request that individuals keep their eyes open for seminal communication and identify it as such.

III. Conclusion

Like the form of learning it espouses, the design and development of an Electronic Learning Community is directly related to the activities of the organization or community. Whether learning is emergent or well-defined, the structure of learning resources must conform to the learning and communication needs of the whole. A framework has been presented here for approaching the design and development of electronic learning resources from a knowledge-centered approach. It has been argued that if an organization or community is to become a self-sustaining learning entity, they must harness the power of

information systems technology and learn to actively manage knowledge in day-to-day activity.

This thesis began by positing a question: Can a generic framework be created which can facilitate the assessment of electronic learning needs, point towards knowledge management solutions and indicate possible technological implementations and agendas for communities and organizations of all sizes? This thesis has addressed these issues, and provides a basis from which to begin to look at the needs of specific organizations and communities. But in order for this question to be answered truly, research and evaluation into the practical application of elements of the framework outlined here is required. In the same way that no two situations are the same, no two organizations or communities are the same and by extension designing and developing learning resources requires more than a generic framework, it requires an in-depth understanding of the context of activity. The major contribution of this thesis is its discussion of context and the diversity of learning needs and desires of organizations and communities. Understanding and addressing the design and development of enterprise learning solutions involves coupling the literature and ideas presented here and elsewhere with an in-depth, cybersystemic understanding of the contextual functioning of the organization or community.

In attempting to provide a generic framework for the design and development of Electronic Learning Communities, this thesis has unearthed a host of research and evaluation issues and questions pertaining to the application of specific methodologies and tools to specific organizations: What methods, processes and technologies can be employed that can support and distribute knowledge, expertise and decision-making? Can evaluation tools and mechanisms be developed that allow people to assess and structure their own learning interventions in day-to-day activity? How can generic tools and technologies be adapted to address specific organizational or communal cultures and environments? What

kinds of observational and self-representational tools can be used by organizations and communities that promote the sharing of learning resources? What kinds of methodologies can be used to identify and document contextual knowledge? How can organizations and communities formulate their own learning interventions, given context and goals?

Answers to questions like these require practical research and evaluation that is firmly nested in, and applied to, the studied environment. This thesis is but a stepping stone to the development of a comprehensive methodology for fostering sustainable learning communities. A comprehensive methodology in education requires the establishment of a wide body of cases that, taken together, may be able to provide a high-level or highly abstracted framework or model that can be generalized to a wide variety of contexts. Developing specific organizational structures must proceed on the basis of case-based methodology: generalizing from a specific case or cases to each new organizational context. This thesis provides an indication as to conditions that can be established to promote learning and sustainability, but research and evaluation of specific conditions requires specific contexts. And the real value of research lies in its application to the studied context. If the history of research and evaluation in education has taught one great lesson it is that there is no predicting the evolution of learning or the needs of learners.

IV. References

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