

Professional Development & Knowledge Management via Virtual Spaces

Noriko Hara and Rob Kling
Center for Social Informatics
School of Library & Information Science
Indiana University
Bloomington, IN 47405
nhara@indiana.edu kling@indiana.edu

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Introduction

In the U.S., the mid and late 1990s was a boom period in many ways that included an expanding economy, a growing emphasis upon the value of people's working knowledge, and a range of new Information Technology (IT) applications and information services that depended upon computer networking - often the Internet. These themes were represented in professional discourse by a special emphasis upon "knowledge work," "knowledge workers," and new practices, such as "knowledge management." While genuine referents for the "knowledge categories" are often elusive, at best they refer to serious efforts of managers to improve their staff's abilities to become more knowledgeable by sharing information and insights within organizations and to leverage their enhanced knowledge for organizational value.

For example, in *Microsoft Secrets*, Cusumano and Selby (1995: 330-339) report the ways in which Microsoft's managers and software developers reviewed major software development projects through extensive and relatively open "project post-mortems" with the aim of improving future software developments. In *Working Knowledge* (1998:6), Davenport and Prusak mention the efforts of managers at Chrysler to develop "Engineering Books of Knowledge" for each new car platform to help to better inform designers of future platforms about more effective design strategies. While Microsoft's post-mortems were based primarily upon written reports and intensive face-to-face meetings, Chrysler's "Engineering Books of Knowledge" represent a 1990's move to use electronic environments as integral elements for helping professionals to share their information and knowledge with others in their organizations.

They also illustrate important forms of professional development. The elastic term "professional development" can refer to almost any way that working professionals are

supported in efforts to increase their capabilities and competencies including courses, mentoring, workshops with experts, discussions with peers, and (in some cases) onsite observation, etc. In this chapter, we will focus on forms of professional development that overlap with knowledge management strategies—especially discussions with peers.

This chapter is divided into five sections. In the first section, new terms, such as knowledge management, professional development, and virtual spaces are introduced. The second section addresses discourses about professional development and knowledge management including e-learning—primarily because e-learning is a means to support professional development with IT and currently receiving intensive attention. For the third section, four case examples are described in order to depict possibilities and problems with professional development in virtual spaces. The fourth section discusses these cases and the implications they have for professional development in virtual spaces. Finally, we conclude the chapter by pointing out the hype surrounding knowledge management and noting that knowledge management is not just an IT system.

In the 1990s, the development of varied IT applications that enabled professionals to share ideas and information at work flourished. These ranged from new forms of groupware, such as Lotus Notes, which consist of online documentary repositories that enabled web-conferencing systems. In educational communities, these were often called Virtual Learning Environments, while in corporate settings these knowledge management systems were often referred to as groupware. In this chapter, we use the term Virtual Spaces to refer to this diverse collection of artifacts. We view learning and sharing professional knowledge as accomplishments that can (sometimes) be facilitated by Virtual Spaces. For example, there were a number of projects that supported professional development via peer conferencing for K-12 teachers, such as LabNet (Spitzer & Weddling, 1995), "Tapped In" (Schlager, Fusco, & Schank, 1998), and the Internet Learning Forum (Barab, Moore, & Cunningham, 2000).

Many of these projects were IT-driven; they tended to focus the majority of their resources on developing the supporting information technologies. However, as we shall show below, the research has found that learning and knowledge sharing are not automatic consequences of the development and deployment of Virtual Spaces. The more successful projects are based on an integrated socio-technical intervention in which supporting social processes are given as much attention as the technological design of the Virtual Space.

Discourses about Professional Development and Knowledge Management in Virtual Spaces

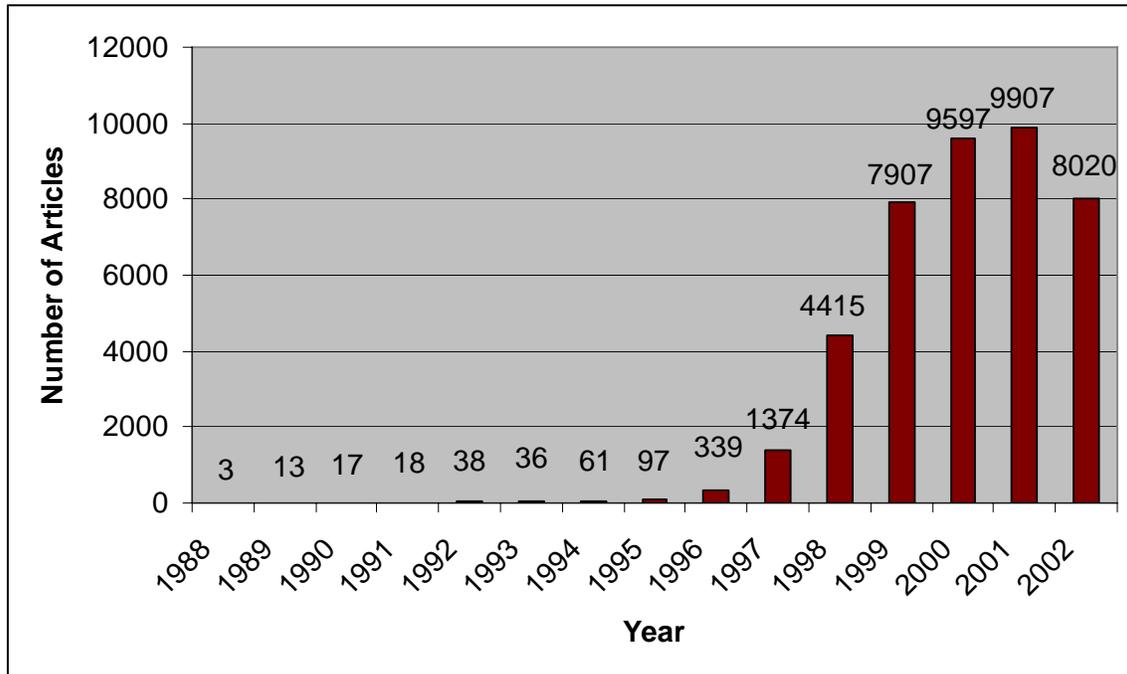
There are several discourses about innovative organizational practices. One set of discourses is very public and appears in mainstream business and professional publications. In the 1990s, much of the professional and popular writing about Internet support activities, including e-commerce, e-learning, and knowledge management was promotional and tinged with technological utopianism (Kling, 1994). In a study of management fashions, Abrahamson (1996) observed:

fashionable management techniques must appear both rational (efficient means to important ends) and progressive (new as well improved relative to older

management techniques). Many management fashion setters – consulting firms, management gurus, business mass-media publications, and business schools – compete in a race to define which management techniques lead rational management progress (p. 254).

The term, "knowledge management" appears to be one of today's fashionable management techniques. Lambe (2002) justifies this perception by listing several indicators: new topical magazines have sprung up; institutes and societies have appeared out of nowhere; new job titles, such as Chief Knowledge Officer, are being invented; etc. He concludes his essay by saying that some knowledge management practices that were adopted as a part of a fashion move may disappear, but that many leading companies have taken knowledge management rather seriously.

Figure 1. Number of Articles in Factiva that Mentioned Knowledge Management



We searched the practitioner literature for articles that mentioned the term "knowledge management" in the information service Factiva that includes articles from approximately 8,000 sources such as major international newspapers and business magazines. On October 27, 2002, a search for "knowledge management" on Factiva retrieved 40,203 articles. We further plotted the numbers of articles that mentioned knowledge management between 1988 and 2001 (see Figure 1). The number started small, i.e., 3 references in 1988, 13 references in 1989, and 17 references in 1990. In this

early stage, most of the articles that referred to knowledge management discussed Knowledge Management Systems, databases, and expert systems. The number of articles in 1996 was more than triple the amount of knowledge management articles written in 1995. During this stage, articles related to consulting practices and strategic management began to appear. The tremendous increase of knowledge management articles did not stop until 2000, when it dropped to a 3% annual increase compared to a 21% increase between 1999 and 2000. In 2002, the number declined approximately 20% from 9907 in the previous year to 8020.

E-learning is another trend that seems to attract many companies. The term e-learning is subject to many slightly varied definitions, but they all emphasize the centrality of some kinds of electronic information technologies to support learning, from CDs to computer networks. E-learning is also used to support professional development with distance education. It has been discussed rather enthusiastically, but without much empirical evidence to support important claims. For example, Davis and Botkin (1994) preached about the vast possibilities of education with technology. However, their focus was more on promoting the technology use in education and less on pedagogies and practical implications. Empirical research conducted by Anderson and Kanuka (1997) found that students who used online forums for professional development reported that they had a difficult time socializing with others and getting their ideas across compared to the use of face-to-face forums. Research (Howell & Stinson, 2001) suggests that a hybrid type of e-learning (i.e., use both face-to-face and online learning) would be more effective than either online or face-to-face alone. In addition, we need to consider specific pedagogies applicable to online environments. Bonk and Cummings (1997) introduced a dozen recommendations for making web-based instruction student-centered.

Although both the field of e-learning and that of knowledge management deal with techno-enthusiasts, the issue of professional development via e-learning and that of knowledge management are slightly different. In distance education, knowledge is "available" in teaching materials, whereas knowledge management projects often require participants to share, not just to "receive" (c.f., Kling & Hara, in press).

Unfortunately, the literature on professional development is scarce and tends to be clustered around different professions. It is a rather application-driven field. Due to rapidly changing technology and increasing knowledge in recent years, professional development has become crucial to various professions (including teachers, physicians, lawyers, and engineers) even though technologies have supported professional development efforts throughout years. For example, Feenberg (1993) described his efforts to support a course offered to corporate executives in the 1980s with computer conferencing. This kind of effort, along with Hiltz and Turoff's (Turoff, 1991), stimulated the use of computer conferencing for professional development, and these ventures did not begin with the public access of the Internet.

A good deal of the professional literature concerning professional development via web conferencing and IT support for knowledge management is written with a high level of normative enthusiasm and relatively little attention to the socio-technical complexities of achieving the desired outcomes. In many cases, IT was characterized as a "magic bullet" (Markus & Benjamin, 1997) that could readily enable important kinds of organizational change without much pain. For example, Davenport and Prusak (1998)

used the efforts of managers in five different locations at Chrysler to develop "Engineering Books of Knowledge" for each new car platform to illustrate their approach to knowledge management. But they never discussed the ease or difficulty that the managers faced in persuading busy engineers to effectively contribute to these "Engineering Books of Knowledge," nor did they ever discuss the actual quality and value of any of these "Engineering Books of Knowledge" whose contents were based on "altruism," i.e., the engineers could not bill their writing time to their own projects. Rather, Davenport and Prusak's readers are encouraged to believe in the quality and value of Chrysler's Engineering Books by implication. Some of Chrysler's managers took these "Engineering Books of Knowledge" very seriously, and Davenport and Prusak saw them as useful examples of knowledge management. However, Davenport and Prusak do not provide evidence on how useful the "Engineering Books of Knowledge" had been to the engineers at Chrysler. They are treating this example of knowledge management strategy as a "black box." In other words, they do not tell us what is happening with the strategy and the tool. They merely present the black box and mention the outcomes of the black box, but not the internal mechanics.

On the other hand, this example also works as a romantic lure that implies that electronically shared Engineering Books in a Lotus Notes database can be used as a technological fix for effectively improving the design expertise of an automobile manufacturer whose products usually had notably more manufacturing defects than their competitors in the late 1990s. In a similar way, much of the professional writing about web conferencing for professional development has amplified the lure of possibilities rather than examined complex socio-technical realities.

One might expect the scholarly research literature to provide a richer and more nuanced understanding of professional development and knowledge management with electronic support. Unfortunately, the research literature concerning knowledge management via Virtual Spaces is very mixed at best. Leidner and Schultz (2002) systematically examined the character of research that was published in six international information systems journals that focused on knowledge management between 1990 and 2000. Over 70% of the 75 studies that they examined were primarily normative, involved consensus-based findings, and were written from the perspective of organizational elites. Studies of this sort would echo Davenport and Prusak and supported knowledge sharing projects such as the "Engineering Books of Knowledge." Only 28% of the studies (21 out of 75) examined knowledge management from the perspective of multiple participating groups and knowledge management practices as seen by these groups. On the other hand, knowledge management projects, such as Chrysler's "Engineering Books of Knowledge," place critical emphasis upon the participation of non-management groups, such as the engineers whose expertise is being sought. It is unfortunate that so little of the knowledge management literature helps us to understand how knowledge management projects look from the vantage point of the participants who have to be mobilized to share their knowledge.

In this chapter, we will briefly describe four empirical case studies of professional development that were supported by Virtual Spaces, such as Lotus Notes, web-based conferencing systems, or LISTSERVs. These include:

(a) the efforts to use Lotus Notes to support knowledge sharing by the consultants of major consulting firms;

(b) the creation of a web-based conferencing system to support on-line classroom visits and discussions of teaching practices by secondary school science and math teachers;

(c) the efforts of public defenders in a metropolitan county court to improve their skills via discussions with other public defenders;

(d) the experiences of in-service teachers who took an online graduate course as part of their professional development.

Case Examples

Lotus Notes in consulting firms

One way to illustrate a contextual inquiry of information technology and social behavior is to examine case studies of organizations. Examples can be found in studies of how some consulting firms have adopted and used computerized documentary systems. The following two cases illustrate the importance of incentive systems. In one case, reported by Orlikowski (1993), the consulting firm did not provide effective rewarding for consultants to share their knowledge. By contrast, a case reported by Ernst & Young revealed that incentive systems promoted knowledge sharing.

One major consulting firm, identified by the alias Alpha Consulting, bought specialized equipment and 10,000 copies of Lotus Notes for their staff in 1989 (Orlikowski, 1993). Lotus Notes, a documentary support system, is superficially similar to an Internet system, with bulletin boards, posting mechanisms, discussion groups, and electronic mail for organizations. Depending upon how Notes is used, it can act as an e-mail system, a discussion system, an electronic publishing system, and/or a set of digital libraries.

Alpha Consulting is an international consulting firm with tens of thousands of employees worldwide (about 10,000 of those employees are located in the United States). Their director of information and technology believed that Lotus Notes was such a powerful technology that its usefulness would be patently evident, and that the main thing to do was to rapidly make it available to the consulting staff and let them use it to find creative ways to share information. The director of information and technology felt that Lotus Notes was so revolutionarily valuable that people did not even have to be shown illustrative business examples of its use, and that providing examples would, in fact, be counterproductive as it might stunt employees' imaginations. The consultants, by being given an opportunity to use it, would learn how to use it in creative ways.

The line consultants were intended to be Lotus Notes' primary users. Organizational informatics researchers found that the senior line consultants, who were partners in the firm, tended to be modest users, while the more numerous junior line consultants, called associates, were low users. These junior consultants often seemed uninterested in learning how to use Lotus Notes, readily gave up if they faced early frustrations with Notes, and, as a group, did not spend much time with the software. What

can explain the differences in practices of use of Lotus Notes between two different groups in the same organization?

One explanation focuses upon the incentive systems in the firm, and starts with an analysis of the different ways that the associate consultants and partners were rewarded. Alpha Consulting, like many other large consulting firms in North America, reviews its consultants via a demanding promotion system. The associates receive an “up or out” performance review every 2 years. In the first few career reviews at major consulting firms, about half of the associates are fired. Associate consultants, afraid of these major layoffs and wanting to be made partners, will not spend the time to learn Lotus Notes due to the lack of company incentive. Once consultants are promoted to the status of partners, they can expect annual incomes of over \$300,000 at these major firms. Partnerships are the golden ring that these firms use to motivate their associate consultants, and partnerships are earned by performance.

The way many consultants in Ernst and Young (E&Y), another major consulting firm, organized Lotus Notes as a more integrated socio-technical intervention is equally instructive (Davenport, 1997; Gierkink & Ruggles, 2002). In brief, E&Y created an organization (Center for Business Knowledge) whose charter was to organize E&Y’s consultants’ know-how in specific high-profile areas. The new organization was staffed with consultants from other E&Y offices who were given 6-month assignments to play a special role as “knowledge networkers.” By 1997, E&Y had developed 22 distinct cross-office networks of consultants with expertise in certain industries, organizational reforms, or technologies that were a focus of E&Y’s business. Each consultant network was assigned a half-time person (the knowledge networker) to codify the insights from specific consulting projects in Lotus Notes databases, to prompt line consultants to add their own insights, and to edit and prune a project’s discussion and document databases. In some cases, they developed topical “Power Packs” in Lotus Notes. These are structured and filtered sets of online materials, including sales presentations and proposal templates. Davenport (1997) observed that these knowledge networkers understood their consultant network’s topics, and that since these were short-term assignments for the consultants, they expected to utilize any newly gained expertise to advance their own careers when they returned to their consulting positions.

In this case, E&Y designed a human organizational “intelligence system” for sharing insights, ideas, and materials in specific topical areas. Lotus Notes served as an information support system -- a medium for storing, organizing, and communicating these materials, rather than as a magnet to mobilize consultants to capture their knowledge so it could be shared with others.

E-forums for professional development among teachers

This case describes the difficulty of community building in an online environment. The Inquiry Learning Forum (ILF) was created in 1999 by researchers at Indiana University’s School of Education as an online forum to support inquiry-based teaching and learning practices among Indiana science and math teachers at the secondary school level (see <http://ilf.crlt.indiana.edu>). The underlying conception was to provide a set of interesting teaching materials, including videos of a class, lesson plans

for that class and the teacher's reflections about the class. Each specific class (such as teaching the Pythagorean theorem) was organized in a separate unmoderated forum with its own threaded discussion list. Teachers could register at any time. While the registrants were screened to insure that they were appropriate teachers (or student teachers), the e-ILF was "open" in the sense that its membership could continually expand. New teachers could join and participate in any of the online forums, long after their discussions had started.

The ILF's organizers expected teachers to discuss the teaching materials, reflect on their own teaching practices, and function as a "community of practice" (Barab, Moore, & Cunningham, 2000). "Communities of practice are informal networks that support professional practitioners to develop a shared meaning and engage in knowledge building among the members" (Hara, 2000, p. 11)¹. By mid-2001, the ILF's support staff worked with 17 teachers to develop videotaped "classrooms" on the ILF's Web site (which we call the e-ILF). Over 200 in-service teachers out of approximately 26,000 secondary math and science teachers in Indiana had registered for the e-ILF, along with nearly 200 student teachers at Indiana University. However, participation in the e-ILF has not reflected the breadth of this membership: statistics collected in March 2001 show that only 29 teachers had logged in five or more times, and 19 had logged in ten or more times. Most discussion in the online forum has been limited to a relatively small group: 31 of the registered in-service teachers had posted five or more messages, and 14 posted ten or more messages. The number of posted messages connected to each "classroom" vary widely, but a typical set of 15 posts is threaded into 6-7 topics with anywhere from 0-3 responses each. The "lounge" section of the Web site contains general topics for discussion, with a typical topic taking up 15-30 posts over a one-year period.

Unfortunately, the difficulties of supporting reflective dialog and community building in on-line forums seem to be under-appreciated within the educational technology communities. Sherry (2000) is all too typical in unreflectively reporting claims that:

One advantage of text-based communication is that written communication tends to be more reflective than spoken interaction. 'The very act of assembling one's thoughts and articulating them in writing for a conference audience appears to involve deeper cognitive processing' (Berge, 1997, p. 10).

Arguments framed in this way make it appear that the use of text-based electronic communication will almost certainly lead to reflective dialogs where assumptions are evaluated, alternatives discussed, contexts carefully explored, etc. However, according to research on typical teaching practices in the U.S., teachers rarely engage in this kind of discussion when they are meeting face-to-face (Little, 1982, 1985, 1990). Perhaps we should not be surprised to find that such reflective discussion does not spontaneously arise in the e-ILF.

¹ This definition is based on the Wenger's elements of communities of practice (CoPs): negotiating meaning between participants; preserving and creating knowledge; and supporting the development of identities (Wenger, 1998).

Our observations of the e-ILF discussions are consistent with mid-1990s research findings from the LabNet project, an e-Forum designed to support the professional development of science teachers. Vanessa DiMauro and Shahaf Gal (1994) examined the on-line discussions of a group of science teacher leaders who were acting as liaisons with the staff of an online professional development project. A network infrastructure was designed to enable these teachers to "exchange messages to reflect upon their peer support." The messages were characterized as informative, responsive (to a query), or reflective (one in which a participant "thinks out loud" about some teaching practice and different ways of approaching it). DiMauro and Gal note that reflective postings were very infrequent. With shrewd insight, they observe that:

"Reflective responses are difficult to formulate and risky to post because of the personal nature of the content . . ."

They speculate about the conditions that support reflective postings, and suggest that they include "protected workspace for reflection, retrieved text base, collaborative research, access and response to messages, structure dialogue, linking action with reflection, forming reflective practice inquiry, and participatory motivation." Some of these conditions are found on the e-ILF (ie., retrieved text base). However, only the Bounded Groups have a protected workspace for reflection. In contrast, postings in the virtual classrooms may be read by any teacher who joins the e-ILF in the future.

By mid-2000, the ILFs designers expanded the range of forums to include some for "bounded groups" where reading and posting were restricted to a specific membership. The bounded groups included teachers who were engaged in a specific curricular reform, as well as classes of student teachers. The bounded groups proved to be much more viable than the open-ended classrooms. The participants of each bounded group usually knew each other and had some reason to believe that their postings would not be read by people who did not belong to the group (other than ILF researchers). Most importantly, members of the bounded groups met face-to-face periodically, and developed some workable trusting relationships in various face-to-face encounters. The e-ILF and its support staff did not face the challenge of developing trust and a sense of community within an exclusively electronic environment. As was the case of E&Y's organization of professional knowledge sharing through Lotus Notes, the technology was seen as supporting complex human relationships that were developed offline.

Developing high levels of collegiality and critical engagement among K-12 teachers has long been perceived as a major challenge. In fact, the nature of the e-ILF interactions described above is consistent with empirical research on teachers' interactions in general, which are characterized by a lack of direct advice or criticism (Ellis, 1993; Little, 1985, 1990). Overcoming this "etiquette" (Little, 1985) and promoting greater critical engagement and sense of group identity might require mechanisms -both online and offline- conducive to forging greater trust among e-ILF's members for open, frank discussions and engagement². In order for the ILF to build

² The best research that we have found about trust building for on-line groups has been conducted by Information Systems faculty who study teamwork online (c.f., Jarvenpaa & Leidner, 1998).

strong mutual ties among members so that it represents a vibrant community instead of a dispassionately used online discussion site, certain structural changes might be necessary to stimulate such engagement, trust, and group identity. Community development is likely to be an accomplishment that is difficult to initiate without purposive interventions from some kind of leader or steward. This will rarely happen spontaneously in online forums.

Listserv for sharing knowledge among public defenders

Hara (2000) examined how two public defenders' offices shared and constructed their knowledge and how they used collaborative IT to learn from each other. It was estimated that 20 percent of the attorneys in a large metropolitan public defender's office used the listserv provided by the state public defender council for defense attorneys in this state. A listserv is an e-mail list which can be subscribed by multiple people and allow them to engage in online discussions. The study used the pseudonym "pubdef-L" for this listserv. About 250 attorneys subscribe to this listserv in order to share information. It is not open to the public. In order to be a part of pubdef-L, a user must be a member of the state public defender council and send in a request to join pubdef-L. The traffic in pubdef-L is relatively heavy. For instance, there were 214 messages within two weeks, between October 1, 1999 and October 16, 1999. Linda Ellis³, a misdemeanor attorney who subscribed to pubdef-L, summarized its characteristics: "There are a lot of experienced lawyers on there, so you get different information. A lot of wisdom comes through pubdef-L to help solve problems and give suggestions, and cite and find cases. It's a good asset." Roy Stewart, a major felony attorney, also had high regard for pubdef-L:

[The listserv is] great because attorneys all over the state are on that, and it's not uncommon for an attorney in a small county to ask a question, "how do I deal with the situation?" and he'll get responses. Other defense attorneys are willing to help. The attorneys all over the state give him some ideas. So, that's really helpful. That's like being able to brainstorm with your whole community of defense attorneys. It all came together within about the last three or four years. Before that, I don't know how people kept in touch (interview with Roy Stewart).

Roy was an experienced attorney, yet he valued the information coming through pubdef-L because he considered it a brainstorming tool within the community of defense attorneys. Further, we infer that pubdef-L helps connect the defense attorneys throughout the state and creates a sense of a community among them.

Pickering and King (1995) examined the motivation for e-mail use in interorganizational communication. They note that "most of the messages posted to Usenet newsgroups are requests for particular information and assistance with problem-solving" (p. 481); the discussions in pubdef-L have similar characteristics. Pickering and King further argue that Interorganizational computer-mediated communication supports dispersed occupational communities. Pubdef-L appears to uphold this function.

³ All of the names in this case description are aliases.

In addition to information sharing and problem solving, Cathy, a less experienced attorney, sees pubdef-L as a great learning resource: "Since I'm new, I just learn a lot, I'm not at a point where [I'm responding much] . . . But I just learn a lot from hearing about different issues." Hence, pubdef-L provides a learning space for less experienced attorneys as well as the more experienced ones.

Angela, an experienced attorney, cautioned that pubdef-L can reduce the opportunities for less experienced attorneys to conduct research by themselves, because the listserv is only for question-and-answer sessions, not for research. There might also be a danger of relying on the information from pubdef-L too much without critically judging its quality. Alex Gordon, supervisor of the major felony attorneys, warned that attorneys needed to be selective about the information that can be obtained through pubdef-L by saying there is "lots of junk in it." Therefore, these attorneys who are on pubdef-L have to evaluate the quality of the information obtained through it. Both Alex and Angela mentioned that their criteria for judging the information was based on the message senders, e.g., whether they are good courtroom attorneys. They both emphasized the importance of knowing court performance. They have been practicing in this field long enough to know most of the other attorneys and their reputations. On the other hand, less experienced attorneys did not mention this type of evaluation process while reading messages on pubdef-L.

In summary, the attorneys appear to use pubdef-L for many purposes: to ask questions, share updated information, brainstorm strategies in trials, discuss current legal issues, and learn from the discussions. The study found that the characteristics of pubdef-L resemble the attributes of the communities of practice⁴. Significantly, this online community of practice appears to have been developed to share legal expertise, partially because it is a closed listserv and most of the attorneys knew each other in courts. However, there are some components that do not exist in this online community of practice. For example, it is difficult to confirm that these defense attorneys develop a shared vision because all members of the community were not necessarily public defenders. Some of the members are contract (part-time) public defenders who are private attorneys.

Coordination Issues in Distance Education

The following case describes coordination issues in a web-based distance education course, B3002 (Hara & Kling, 2000). It is an ethnographic case study of students' experiences in this course undertaken in 1997. One major aim of the study was to understand the experience of taking an asynchronous text-based, Internet-enabled course from the point of view of its student participants. At the time, very few such studies had been completed. While students' perspectives are sometimes represented in the research literature, they are generally gleaned through course evaluation forms

⁴ Hara(2000) studied four different communities of practice: one in a small office, one among experienced attorneys in a larger office, one among less experienced attorneys in the larger office, and one in online.

(Rossman, 1999) and concise characterizations based on students' comments or experiences.

In this case, the students and instructor relied upon e-mail as a primary means of communication. In fact, the instructor required that students post e-mail to the class discussion forum "at least 5 times during the course." Her syllabus also noted: "Participants are expected to check the list daily." The students and the instructor in B3002 generated intensive on-line discussions through e-mail, and all of the students posted far more than 5 one-to-two page-long messages. During the week of October 19th they posted 35 messages; this volume was common throughout the semester. On the surface, this volume of discussion indicates a lively class. However, we found that there were some underlying problems with the reliance on e-mail.

First, it was evident that some students did not read other people's postings before writing their own e-mail messages. Second, some students were unable to make time to read and post e-mail during short intensive discussion periods. For example, one student did not post any comments when the other students intensively discussed a particular topic for two days in the middle of the semester. After another student summarized the overall discussion in his e-mail, she sent an e-mail that had a subject line saying, "Ah ... I cannot catch up with all of you : (." She was one of the students who posted the fewest number of e-mail messages to the on-line class discussion. Some other students also reported that they were overwhelmed by the volume of e-mail, and that they fell behind in reading and responding on-line. The research literature indicates this complication of asynchronous computer-mediated communication. Wegerif (1998) also reports a student's comment of the "daunting prospect" of being behind reading messages. In this course, the instructor and students did not discuss the question: how much posting is sufficient to satisfy the course requirements?

As noted in the above example, the discrepancies between students' behaviors and the instructor's expectations were a major issue. Another example is of a student who was working at night alone in a computer lab and had not received specifications for the assignments from the instructor; he was confused about the instructor's expectations. In this course, the students and instructor did not have discussions about each other's expectations, e.g., how long it takes for the instructor to get back to students' questions in general. The students did not know whether they should expect to receive replies within 24 hours, 72 hours, or a week.

A major advantage of asynchronous computer-mediated communication is that it reduces the constraints of time and location (Ahern and Repman 1994; Burge, 1994; Harasim, 1990; McIsaac and Gunawardena 1996). However, it can be very demanding for students and instructors to read all their messages and to respond thoughtfully (Hara, Bonk and Angeli, 2000; Hiltz 1998; Kang 1988; Wiesenbergs and Hutton 1995). The instructor also commented that at the beginning of the semester she was spending all day doing nothing but reading and responding to e-mail messages. Later in the semester, she was able to reduce her workload, because she became familiar with how to handle e-mail messages for the course (i.e., not spending too much time on individual messages), but still spent a large amount of time on this course.

Discussion

Social processes in Virtual Space

One of the key issues that has not gained attention in the research, and particularly in practice, is that workers' incentive structures influence the level of knowledge sharing within Virtual Spaces. This issue is not specific to the activities within Virtual Spaces. In general, people in certain organizations are hesitant to share their knowledge because they might lose their competitive edge. An article in *The Wall Street Journal* reports a view from the shop floor on knowledge management (Aeppel, 2002). It reports that many workers resist sharing their knowledge in workplaces, because they are afraid of losing their jobs once the companies have the knowledge. In order to encourage knowledge sharing, incentive systems need to be changed, so that workers will be rewarded, instead of punished, when they share expertise. This incentive issue was illustrated by the first two cases: the Alpha Consulting firm (Orlikowski, 1993) and Ernst & Young (Davenport, 1997). The former case did not succeed in supporting the sharing mechanism because the management did not take the incentive structures into consideration. Conversely, E&Y altered their original incentive structure in order to reward the knowledge sharing process.

As Markus and Benjamin (1997) note, many IT practitioners perceive IT as an enabler "magic bullet". However, IT applications are not sufficient by themselves; one needs an associated social process to encourage participation. As illustrated in the case of E&Y, social processes, such as incentive structure and organizational structure, need to be architected so that people participate in intended activities—in this case, knowledge sharing. In the ILF case, the tool was developed without consulting with the actual users, i.e., teachers. ILF did not have the materials that the teachers needed for their immediate use, did not consider the time constraints of teachers, and did not engage in community building to offer a safe environment for teachers to give each other critical feedback. As a result, ILF suffered from low participation. These two cases vividly illustrate the importance of installing social processes as well as technical applications.

Trust issues also have to be worked out between participants to enable sharing potentially embarrassing "knowledge" and practices. This issue was described in the ILF case, in which teachers were afraid to criticize other teachers' teaching or postings. Once they posted their messages in the classroom e-forums, they could be viewed by any teacher who registered for the e-ILF. However, they were not given opportunities to get to know each other very well and, hence, were unable to develop the trust necessary for meaningful rapport. Consequently, their postings ended up becoming self-reflection, rather than more useful mutual feedback. It is very difficult to establish trust in virtual environments (see Jarvenpaa, & Liedner, 1999). One way to facilitate the development of trust is through face-to-face meetings.

On the other hand, the pubdef-L listserv provided an online space in which participants who worked in many different city and county courts were willing to share certain legal knowledge. Some of the participating lawyers knew each other personally; and they participated in a relatively small, relatively stable professional world of public

defenders in their medium-sized state. Violations of trust could be readily known and "come back to haunt" the violators.

Coordination issues can be complicated in distance education courses. Hara and Kling (2000) emphasize that students' ongoing desire for "prompt unambiguous feedback" is much more difficult to achieve in text-based asynchronous courses than in face-to-face conditions. For instance, students working on the course during late evenings and weekends had to wait longer for the instructor's feedback. This issue could be even more amplified in larger classes. What is needed is for students and instructors to learn how to negotiate their expectations about when they should be able to have reliable, fast communicative responses.

Part of the communicative complexity of constructing adequately unambiguous conversations via text-based media comes from trying to anticipate the level of detail and phrasing that will be sufficiently helpful to others. But, as Hara and Kling noted, their informants were also unsure what meta-communicative conventions would be appropriate in their on-line conversations. E-mail that represents the nodded heads of a face-to-face group could be valuable to an instructor to confirm others' understanding. Or it could result in yet more e-mail glut. These kinds of practices need to be negotiated within each group. In B3002 and many other courses, both face-to-face and on-line, participants do not explicitly question and negotiate meta-communicative conventions—even when they are confused and frustrated. These discussions and negotiations require a higher level of social skills from all participants, and their enactment (for instance, the creation of a strong social presence in a written medium) also requires time and expressive capabilities. This is not well explained in the literatures of e-learning or distance education.

Both authors taught online Ph.D. seminars for short-terms. The seminars were two-weeks long. One author was contacted by a person at the university about teaching a two-week online seminar during the fall semester. Since she had other teaching obligations during the regular semesters, she specifically asked to teach it over the summer, but was told that it was not possible. She was then contacted by a coordinator of the Ph.D. program to post some instructions for the students in their online space. Shortly after that, she was asked to contact a technical support person. While waiting to receive log-in information from technical support, she was frequently asked to log-into the system by the coordinator. This instance indicated that the technical support person and the coordinator had not interacted with each other. When she was finally able to log-in to the system, more than 10 messages from the students were posted. One of the messages said that the students had been given an article in July and had been waiting for the seminar to start since that time. Apparently there was miscoordination, miscommunication, and misunderstanding among the instructor, students, the technical support person, the person who originally contacted the instructor, and the coordinator. The other author taught the same online seminar during the previous summer. He experienced other coordination issues with his students since they did not know what the expectations were with regard to a time frame for responding to messages. Therefore, it is important to note that distance education courses require substantial forethought about communications and coordination that are usually not problematic in face-to-face classes.

Differing Social Organization of E-forums across types and within types

E-forums can be a component of Virtual Spaces. One way to facilitate e-forums is to consider five socio-technical issues.

1. First, e-forums organizers and participants need to determine who can participate and who is excluded. For example, the listserv among public defenders was restricted to defense attorneys. Thus, the attorneys felt comfortable brainstorming strategies for trials and asking questions about judges and prosecutors. If they were uncertain about who was reading the messages, they would not have freely discussed the above matters. Similarly, the bounded groups of the e-ILF facilitated discussion by restricting their membership.
2. Second, the genres of acceptable communication need to be established in e-forums. Some Virtual Spaces make it more explicit than others. For example, a mailing list among educational researchers facilitated by American Educational Research Association periodically sent out messages that listed the rules for the mailing list, such as what and what not to send to the list. E-forums need to articulate what topics are appropriate for their e-forums.
3. Third, participants' activities (e.g., speak/post, read, role-play, buy, sell, etc.) need to be identified. For instance, eBay clarifies the roles of participants with their accounts. The users need to create separate accounts for sellers and buyers. Sellers' information is available in public for buyers to make decisions whether they want to buy items from particular sellers. Some e-forums have restricted speakers, yet other people are allowed to view their activities without participating in the discussions.
4. Fourth, acceptable communication conventions should be determined. This category concerns norms for online behaviors. Do you politely correct others or flame them? These questions need to be discussed. On the other hand, if participants are not certain about the expectations of the e-forums, the participation rate might be reduced. In the case of the ILF, the teachers did not have a clear understanding of what comprised acceptable communications within the e-forum. They were not sure whether the video clips were supposed to be bad examples or good examples of teaching practice, or how much criticism would be acceptable in that type of e-forum. There were no discussions about this point among the participants, and it was not explicitly explained to them at the beginning.
5. Fifth, social control agents and practices need to be clarified. Some e-forums are established and enforced by e-forum organizers and some are by participants.

More often than not, designers of Virtual Spaces tend to overlook the fact that these socio-technical factors need to be in place. These five issues must be effectively addressed if an e-forum is to be successfully implemented. For example, e-ILF did not consider these issues. As such, there was little participation in the forum.

Hara's (2000) study of the listserv among public defenders identifies different types of working knowledge including book knowledge, practical knowledge, and cultural knowledge. Cultural knowledge is very difficult to share online. Consequently, we need to identify what kinds of knowledge to share and what types of tools to support such knowledge sharing.

Hara coined the term "cultural knowledge" in reference to the social nuances of the role public defenders play; it includes their professional identities as defenders of indigent people who often have been mistreated. Most of the tacit knowledge that is necessary to become a full member of the community of public defenders is embedded in the culture of the public defender's offices. Therefore, younger attorneys learn how to be public defenders by observing more experienced attorneys and by talking with them. As Huseman and Goodman state, "culture is one of the most powerful stores of knowledge" (Huseman & Goodman, 1999, p. 121).

In a community of practice, knowledge is constructed socially rather than individually. There are three types of knowledge that the members have to learn: cultural knowledge and two kinds of subject-matter knowledge.

Hara further classified subject-matter knowledge as either book knowledge or practical knowledge (see Hara, 2000). Book knowledge refers to mere facts, such as case laws and statutes. In contrast, practical knowledge refers to using the book knowledge in practice; for example, how to use the latest case that an attorney found in Lexis-Nexis⁵ in a bench trial. The attorneys have learned most of their fundamental book knowledge in law school, but they also have to keep learning new book knowledge because criminal laws are rapidly changing. In addition, they have to learn how to use their book knowledge, which will eventually become practical knowledge. In some communities of practice, the subject-matter changes rapidly (e.g., communities of practice among lawyers) and sometimes cultures change rapidly, perhaps because of the high rate of turnovers⁶. Therefore, it is imperative to address the learning of subject-matter knowledge in communities of practice.

Different types of knowledge require different learning formulas. Cultural knowledge and partial practical knowledge are tacit. Apparently, the mechanism of learning cultural knowledge and some practical knowledge relies on observing experts doing their work. On the other hand, parts of practical knowledge and book knowledge are explicit. Therefore, explicit practical knowledge and book knowledge can be shared through documents and electronic formats, such as messages exchanged through a listserv. As mentioned, not all kinds of knowledge are easy to share in online environments. The designers of Virtual Spaces ought to be aware of these limitations when providing learning opportunities in Virtual Spaces.

In our view, Virtual Spaces needs to be designed socio-technically (Kling, 2000). Designers may try technical means (such as IP-address checking or personally-reviewed registration) to limit participation to some kinds of people or groups. An e-forum's charter may describe the kinds of acceptable communications, but, without human review, it may be difficult to enforce. The e-forum may enable some specific kinds of activities while providing no explicit support for others. Also, the e-forum may be designed so that any group of participants may easily form their own (private) group, or

⁵ Lexis-Nexis is a database that provides full-text access to a variety of topics. In this case, attorneys use it to search information about state law.

⁶ The original definition of a community of practice by Lave and Wenger (1991) appeared to be concerned about only static cultural knowledge and subject-matter knowledge. However, many jobs require the learning of subject matter that frequently changes.

they may require the assistance of an e-forum administrator, or it may be effectively impossible. It is easy to set up an online conferencing system on the Internet for people to participate. However, the technology itself does not facilitate the process by which people share thoughts and ideas and build a community. There needs to be social support mechanisms embedded in the e-forum.

Conclusions

As noted earlier, knowledge management and professional development in virtual environments is much more difficult than in face-to-face settings. We suggest that the notion of knowledge management is too narrow to support knowledge creation and sharing activities in workplaces, and that incorporating the socio-technical perspective would enrich the online community and thus create a supportive learning environment. Knowledge management literature as well as e-learning and other technical focused fields are likely to focus too much on the technological issues. We strongly support the socio-technical perspective that considers social processes that would support the intended activities in addition to the technology itself. It is easy to develop a piece of software and name it Virtual Spaces, but it requires more effort and consideration to develop Virtual Spaces that *facilitate learning*. When IT fails to facilitate social processes, its effect on knowledge management is limited.

In the literature of knowledge management, knowledge management itself is often “black boxed.” A large portion of the literature does not address the workplace issues as experienced by potential participants, such as incentives for participating, trust that their communications will not hurt their status in their workplaces, the commitments of others to participate, and time to participate. As represented by the case of "Engineering Books of Knowledge" at Chrysler, knowledge management strategies or technologies are described, but these cases do not address the issues of the people who are involved in, and influenced by, the knowledge management initiatives. We certainly need to understand how the people on the floor use the technologies, what are the problems are that they face, what works, and what does not work. In the framework of Leidner and Schultze's study (2002), we need more studies with local perspectives.

By understanding local perspectives, we can fully incorporate socio-technical considerations into design and implement virtual spaces that support professional development and knowledge sharing. The socio-technical aspects that we need to pay attention to include: identifying needs of users/learners; developing trust among users; installing incentive structures for knowledge sharing; and determining users, their communication topics, norms, and behaviors. It is important to recognize that virtual spaces are more than an IT system allowing communication and data exchange.

As a field that is focused on technologies, it is easy to jump on the bandwagon of newly fashionable technology-based techniques, such as e-learning or knowledge management. Professionals who organize professional development through virtual spaces need to remember that the technology does not make learning better, but rather it is that the pedagogy and social processes that facilitate better learning. If this is not the case, many IT applications for virtual learning environments will end up going through a cycle of high expectations followed by relatively uneven and low participation rates; and these in turn will be followed by disillusion and disappointment.

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