# Situated Learning in Cross-Functional Virtual Teams

Daniel Robey

Huoy Min Khoo

Carolyn Powers

Georgia State University

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Summary

This paper reports an interpretive study of three cross-functional teams in a single company. The teams were virtual because each was composed of workers located in a small southern U.S. town and a cosmopolitan northern U.S. city. The conceptual framework of situated learning within communities of practice guided the interpretation of transcripts of interviews with 22 managers and team members. The results suggest that virtual teamwork creates special demands, which require workers to devise local practices for coordinating their work with remote team members. Through different combinations of remote and face-to-face communication, using a variety of communication media, the learning of work practices becomes situated in the virtual community rather than imposed by managers or specially designed coordinating technologies.

With the advent of worldwide connectivity through the Internet and other telecommunications technologies, organizations are increasingly adopting “virtual” organizational forms that operate more independently of time and space than traditional organizations. As a result, more professional workers are finding themselves as members of virtual teams, consisting of members in remote locations who work together primarily through computer-mediated communication (Grenier and Metes, 1995; Townsend, DeMarie, and Henrickson, 1998; Lipnack and Stamps, 1997). In many cases, virtual teams include members from different functional areas of an organization, thereby increasing the team’s coordination requirements. Customers, vendors and other business partners may also contribute membership to virtual teams, further increasing their diversity and their communication and coordination requirements. Although they typically operate from remote locations, members of virtual teams must execute a large number of intricate and interrelated tasks in order for virtual teams to be effective. Frequently, members of virtual teams are not closely supervised. Rather, they function as empowered professionals who are expected to use their own initiative and resources to contribute value to customers and other stakeholders (Hammer, 1996).

This study investigates the ways in which members of cross-functional teams learn work practices that allow them to meet the challenges that their virtual status poses. The study conceives of virtual teams as communities of practice (Wenger, 1998; Brown and Duguid, 1991; Brown, 1998) and focuses on learning that is situated in work practice rather than on knowledge that is acquired outside of the context of actual work. According to this theoretical perspective, participants in a community of practice learn work practices that satisfy their local needs, and they often ignore or neglect formally prescribed practices that are seen as less relevant to performance (Orr, 1996). Understanding how such learning occurs and how it affects team performance are important issues, especially in the context of virtual cross-functional teams. To investigate this issue, we interviewed 22 workers and managers in three cross-functional teams in a single large

company. The teams bridged not only functional divides but also geographic and cultural ones, and members used a variety of media to manage the production and delivery of goods to serve customers. The findings reveal how team members responded to the demands of the team arrangement, how they communicated in both remote and face-to-face encounters, and how their learning was situated in virtual communities of practice. The results extend the theoretical concept of situated learning to virtual teams and generate several practical implications for managing virtual cross-functional teams.

## VIRTUAL CROSS-FUNCTIONAL TEAMS

Traditional organizations are designed around work functions, wherein specialists from a particular occupational category are grouped together. The functional organization structure is frequently criticized because it increases the communication and coordination requirements across functions. Managing conflicts across functional boundaries in organizations is a research concern that spans at least 30 years (Walton and Dutton, 1969; Walton, Dutton, and Cafferty, 1969; Kusunoki and Numagami, 1998). To facilitate cross-functional coordination, many organizations have created teams in which members of various functions work together to bring their respective skills and perspectives to a common work output (Wynn and Novick, 1995). For example, process-reengineering and supply-chain management efforts undertaken throughout the 1990s resulted in the creation of many teams focused on customers instead of functions (Grenier and Metes, 1995; Greis and Kasarda, 1997). These teams often become microcosms of the larger functional organization and must develop internal means for managing inter-functional conflicts.

Perhaps the most commonly prescribed and least controversial means for overcoming cross-functional differences is communication (Kusunoki and Numagami, 1998). Although an obvious solution, obtaining effective communication within cross-functional teams has always been difficult. Even in high-performing teams, communication across functional divides presents a

constant challenge for members who must simultaneously represent their trained specialization and subordinate their interests to the shared goals of their teams (Pinto and Pinto, 1990).

Contributing to the challenge of effective cross-functional communication is the fact that an increasing number of cross-functional teams span geographic and temporal boundaries. These virtual teams may contain members of one organization working in different locations around the world, members of other organizations with shared business interests, and customers (Lipnack and Stamps, 1997). Virtual organizational forms have become popular, and the professional management literature consistently promotes the virtues of going virtual (Boudreau *et al*., 1998; Davidow and Malone, 1992; Grenier and Metes, 1995; Townsend *et al*., 1998). Much of the academic and professional interest in virtual teams so far has been upon the quality of supporting technologies and their contribution to knowledge generation and knowledge sharing, e.g., (Gorton and Motwani, 1996; Marshall, Shipman, and McCall, 1995; Osterlund, 1997). However, deploying those technologies in an organization does not determine how they will be used. In practice, teams appropriate specific features of available technologies and employ them to support their particular work needs. Some uses of enabling technologies in virtual teams may conform to the expectations of managers or researchers (DeSanctis and Poole, 1997). Others uses, however, may develop out of unique and unanticipated needs of a team members and represent contradictory or paradoxical uses of technology (Robey and Boudreau, 1999). One of the objectives in this study is to shed light on the ways in which members of cross-functional virtual teams actually communicate and learn to adjust to their task requirements.

## RESEARCH ON LEARNING AND COMMUNICATION IN VIRTUAL TEAMS

Researchers have studied virtual teams using a variety of theoretical concepts and research methods, but no general framework has yet been produced to guide research on situated learning in virtual teams. Reviews on virtual organizations (Robey, Boudreau, and Storey, 1998), virtual teams

(DeSanctis and Poole, 1997), and related concepts such as remote work (Belanger and Collins, 1998) have begun to appear. However, none of these focuses on the processes whereby members of virtual teams learn as they participate in practice. In the absence of such an organizing theoretical framework, the present research relies upon related empirical studies to illuminate topics believed to be relevant to the study of learning in virtual teams. Collectively, these studies provide findings about work demands and learning in virtual teams, and about communication and media use. We also review research relevant to learning situated in communities of practice.

## Work Demands and Learning in Virtual Teams

A common presumption about virtual teams is that most workers will experience them as novel forms. This will probably not be the case in the near future, but it is a safe presumption today. Thus, Townsend and his colleagues (1998) argued that virtual team members must learn to "rebuild interpersonal interaction" because traditional, face-to-face interactions will be replaced in great degree by remote communication. The novelty of virtual teams thus poses a significant demand on members to learn new ways to behave and interact. Virtual teams are also demanding because they frequently empower members to act more independently from direct supervision (Grenier and Metes, 1995). Unlike traditional novelty effects, which are transitory in nature (Robey and Bakr, 1978), the demands imposed by empowering team members represent ongoing challenges. Cross-functional teams in particular are unlikely to settle into routine problem solving under the direction of watchful supervision. To the contrary, cross-functional teams are formed to resolve nonrecurring problems. Because cross-functional teams are often focused on satisfying customers, whose expectations may change frequently, teams may face a steady flow of new demands rather than transitory novelty effects.

Research studies confirm these expectations about the demands facing members of cross-functional virtual teams. In one of the few studies to investigate the novelty of virtual work,

Whiting and Reardon (1998) surveyed employees from ten regional offices of a *Fortune* 500 firm. Of 373 sales and systems engineering employees, 186 moved to the virtual office and the remaining 187 remained in traditional work settings in regional offices. Two surveys were conducted: the first mailed to participants during the transition to virtual work, and the second administered one year after the transition. Whiting and Reardon showed that during the transition, virtual office members were less committed to the organization than were their colleagues in the traditional office. The researchers explained this result in terms of the insecurity that members experienced regarding their future in the organization. Following the transition, however, no significant differences were found in the level of commitment between employees in virtual and traditional offices. This result suggests that novelty effects were overcome and that virtual workers had adjusted to the change.

Several studies have emphasized the importance of learning as a response to the demands of virtual teamwork. Staples, Hulland, and Higgins (1998) gathered responses from 376 workers who worked remotely from their managers in 18 North American organizations. The employees with greater experience and training at working remotely had higher levels of remote-work self-efficacy, which led to higher job performance and more positive job attitudes. Also, those with higher information technology skills had higher remote-work self-efficacy. Workers learned their communication practices by modeling their managers' behaviors, which in turn led to greater self-efficacy, higher performance, and more positive job attitudes. In a study of three global virtual teams, Maznevski and Chudoba (forthcoming) also found communication patterns to be associated with team effectiveness. Communication incidents that fit the teams' structures and processes were judged to make teams more effective. These results support the conclusion of Belanger and Collins (1998) regarding the importance of self-sufficiency, reliability, and communication skills in remote work.

**Communication and Media Use**

Most studies of virtual teams emphasize the importance of communication to accomplishing team requirements for coordination and efficient task execution (DeSanctis and Poole, 1997). Effective teams need to find ways to fulfill task expectations while meeting other social outcomes like satisfaction, organizational commitment, organizational identity, cultural understanding, and trust. However, because virtual teams typically span functional, geographic and cultural boundaries, the volume of communication within teams may increase and be transmitted via a wider assortment of media

Empirical studies support the important role that communication plays in virtual teams. In Whiting and Reardon's (1998) study, the impact of formal and informal communication on organizational commitment was greater for virtual office employees than for those who worked in traditional offices. Communication thus played a more important role in virtual organizations than it did in traditional offices. Grabowski and Roberts (1998) argued that communication is essential to mitigating safety risks by helping to clarify potential threats to worker safety and by opening dialog on improved work practices. When virtual teams span the boundaries of individual organizations, communication at the interfaces allows different cultures to be melded into a cohesive whole. However, attention must also be given to the design of control systems that promote safe behavior. Jarvenpaa and Leidner (1998) also found that communication was an important factor contributing to trust in virtual teams composed of students from different universities. They found that social communication complemented task communication: members who explicitly verbalized their commitment, excitement and support were seen as more trustworthy. Kraut and his colleagues (1998) also found the use of electronic networks and personal relationships to be complementary. Finally, Weisenfeld, Raghuram and Garud (1998) found that communication was instrumental to increasing organizational identification in virtual teams through the sharing of norms, values and culture.

It is difficult to understand communication in virtual teams without appreciating the variety of communication media and technologies used by team members. It is widely acknowledged that advanced applications of information technology have enabled the creation and spread of virtual organizations, virtual teams, and other form of distributed work. Technologies such as video conferencing, collaborative software, and Internet/Intranet systems now supplement earlier technologies such as electronic mail, telephone/voice mail, and facsimile transmission (Townsend *et al*., 1998). Technology-enabled communication may, however, not completely replace face-to-face meetings or the mailing of printed documents. Thus, members of virtual teams are typically faced with a greater number of choices of media, protocols and formats. Greater variety may lead to more flexibility, creativity, and responsiveness to both internal and external demands, but it may also lead to confusion and reluctance to use technologies like electronic mail that jeopardize personal privacy (DeSanctis, Staudenmayer, and Wong, in press).

In the face of this wider range of choices, team members must learn to mix old and new technologies. A recent study (Sarbaugh-Thompson and Feldman, 1998) showed that electronic media use tends to reduce the incidence of casual conversations and greetings, thereby reducing overall communication. To compensate for such effects, teams may be designed so that social greetings can be restored through periodic face-to-face meetings. Kraut and his colleagues (1998) found that the uses of electronic media and personal relationships complemented each other in dealings with external suppliers. Maznevski and Chudoba (forthcoming) also found that face-to-face meetings in global virtual teams provided a “deep rhythm,” which permitted intense focus during short intervals and less intense focus during longer intervals of remote communication using electronic media. Thus, it appears that face-to-face communication may be an important ingredient in making virtual teams more effective.

**Learning Situated in Communities of Practice**

Virtual teams constitute a variation on what Wenger (1998) described as a "community of practice." According to Wenger, the idea of community provides:

> …a way of talking about the social configurations in which our enterprises are defined as worth pursuing and our participation is recognizable as competence. …Practice refers to the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action (Wenger, 1998: p. 5). …These practices are thus the property of a kind of community created over time by the sustained pursuit of a shared enterprise (Wenger, 1998: p. 45).

Learning within such communities is situated in practice. New members assume roles as peripheral participants, initially performing a limited range of activities under the guidance of more experienced community members (Lave and Wenger, 1991). As peripheral members gain experience, they become more complete participants. Their learning is thus situated in practice, rather than formulated and delivered outside of the context of practice. Situated learning thus differs from formal training, in which knowledge is codified and transferred to learners in special training sessions. Situated learning occurs within communities of practice as members adjust to each other's needs. In some corporations, such as Xerox, awareness of situated learning has led to revisions in training programs so that members of teams may learn together within a shared work space (Stamps, 1997). Such practices are undertaken with the full recognition that communities of practice rarely follow "corporate doctrine," or implement "canonical knowledge." Rather, communities of practice establish idiosyncratic knowledge that reflects local experience and meets local requirements. Tacit knowledge is generated and transferred by members as they work together (Nonaka, 1994).

Most examples of situated learning involve communities of practice that are geographically proximate, that is, communities that share space and time. In proximate settings, the elements of social interaction, physical activity, and physical setting assume central importance in situated learning. For example, workers in traditional offices, production plants, and research laboratories share space and interact frequently, making it possible for peripheral participants to learn through direct communication with more experienced colleagues (Brown and Duguid, 1991; George,

Iacono, and Kling, 1995; Tyre and von Hippel, 1997; Wynn and Novick, 1995). Their learning includes visual, tactile, and verbal communication and may result in such outcomes as psychological safety for team members and effective team performance (Edmondson, 1999).

In virtual teams, where the community of practice is geographically distributed and temporally disconnected, opportunities for visual, tactile, and verbal communication are limited. Virtual arrangements potentially threaten the process of situated learning because members are not located together. As a community of practice, a virtual team must generate local knowledge when its members are not local. Its situated learning must occur outside of a physical situation and be generated by persons who may never meet face to face. These requirements pose serious challenges to members of teams, for designers of support technologies, and for managers and customers who depend on teams to perform effectively. While members may be trained in the principles and procedures of the technologies that bind them together, virtual teams may decide to appropriate some features and to ignore others, despite their apparent advantages. Moreover, teams may "reinvent" technologies to work in ways that satisfy locally understood team requirements, regardless of the intended uses of the technology. These effects are well established in the literature on traditional teams, and they are likely to be more pronounced in virtual teams, which depend even more on information technologies (Robey and Boudreau, 1999).

Beyond their understanding of tools and technologies, virtual team members must also develop communication practices that operate across time and space. They may develop electronically mediated substitutes for the visual and nonverbal cues that operate in teams that meet face-to-face. They may create rules of conduct, social structures and temporal rhythms that enable them to perform their work effectively. And they may learn to manage conflicts and disagreements in ways that make members feel psychologically safe. They may even form social and emotional bonds through their electronically mediated interactions. All of these practices are situated within the virtual cross-functional team, and this study seeks to understand how such learning occurs.

## METHOD

An interpretive methodology is employed in this research. An interpretive methodology makes the fundamental ontological assumption that social reality is constructed and interpreted by actors rather than being objectively definable, *a priori* (Deetz, 1996; Orlikowski and Baroudi, 1991; Walsham, 1995; Mason, 1996). The research methods that fit this assumption seek access to social actors' subjective knowledge. Accordingly, the methodology used in this study relies upon interview data and qualitative data analysis. This methodology is appropriate because learning that is situated within a community of practice is likely to occur in ways other than those imposed by an *a priori* research framework. Thus, an interpretive methodology is designed to generate inductively constructs relevant to individuals and their work, which can be assessed through responses to open-ended questions about aspects of practice. Respondents' interpretations of their own experience in cross-functional virtual teams are likely to be a valuable foundation for building knowledge about situated learning within them.

Interpretive methodology requires that the researchers' own subjectivity be acknowledged (Mason, 1996). In this study, we are motivated to produce knowledge that will be useful in making cross-functional virtual teams more effective for a variety of stakeholders, including managers and team members.

The site chosen for this research is the largest division of a U.S. soft goods manufacturer and importer, here given the pseudonym SoftCo. SoftCo had sales of approximately $300 million in 1998, when the study was conducted, and competes in an industry that has undergone significant changes over the last decade. Faced with the demands of more globally distributed manufacturing and increased customer demands for more timely fulfillment of their orders, many firms in SoftCo's industry failed to survive. SoftCo coped with these pressures by forming closer alliances with both customers and suppliers in order to coordinate inventory, shipping, and manufacturing schedules

more tightly. A process-reengineering project conducted in 1995 emphasized better management of the supply chain and created three teams focused on specific customer groups. Each team was both virtual and cross functional. Each team included sales and/or merchandising personnel from one cosmopolitan northern U.S. city (hereafter referred to as the North) and administration, product development, production, and customer service personnel from the division headquarters, located in a small town in the southern U.S. (hereafter referred to as the South). Each virtual team also included people located in other places, such as geographically remote sales personnel, customers, and suppliers. The teams were also permanently established, which enabled access to retrospective accounts of work within the teams by members who had experienced the transition to teams three years earlier. Figure 1 shows the teams schematically.

----Insert Figure 1 about here----

SoftCo was selected as the research site because its virtual teams spanned corporate functions as well as culturally and demographically diverse regions of the U.S., thereby increasing their coordination and communication requirements. The origin of cultural differences between the North and the South locations is embedded in historical circumstances that once separated northern and southern states politically. Although the U.S. Civil War ended over 100 years ago, regional differences in dialect and customs prevail. Moreover, North-South cultural differences are related to the cosmopolitan character of the Northern city and the more local or traditional character of the Southern town.

Data were generated (Mason, 1996) using face-to-face, in-depth, semi-structured interviews with 22 individuals. Two interviewers conducted most interviews, but either one or three interviewers conducted some of them. All interviews were tape-recorded after interviewers assured confidentiality and obtained permission from the respondents. The interview protocol included six broad topic areas, but most interviews followed a natural course, wandering to topics of interest to the respondent. Interviews lasted between 40 and 60 minutes and were conducted at either the South

or North locations. The manager and at least two team members were interviewed in each location; interviewees are identified by bold type in Figure 1.

During the data generation period, the research team recorded and shared their preliminary impressions. These field notes included casual observations of office layout, dress and physical appearance of employees, and other considerations. However, prolonged systematic observation of people at work was not possible. The interviews were primarily conducted in a room reserved for that purpose.

Following transcription of the interviews, two of the researchers coded the data using the following five categories:

- demands of virtual work
- process of situated learning
- use of technology
- role of face-to-face meetings
- management.

These *a priori* codes were not tied to a specific theoretical framework, but rather treated as a starting position for analyzing the data. Coding categories were based upon the interests of the researchers, the nascent literature on situated learning, and impressions gained during the interviews themselves. After both coders had coded the same ten interviews, they compared their results in order to modify coding categories. Disagreements were discussed, and the coding scheme was expanded to include two additional categories:

- communication
- effectiveness.

These categories thus arose out of the data themselves (Mason, 1996). All transcripts were then coded or re-coded using these new categories. The coders divided the set of transcripts, each coding half of the total. One of the coders had participated in approximately 19 of the 22 interviews, and

the other coder had not conducted any interviews. No computer-aided analysis tools were used in the coding process.

The analysis continued by examining the statements made under each coding category and inducing a parsimonious framework to describe the overall pattern of results. The coding category of effectiveness was not included in the framework because all respondents considered their teams to be effective, so our analysis was unable to distinguish factors accounting for differences in effectiveness. The category of management was not treated separately in the framework because managers were included along with team members. Finally, we found the three teams to be relatively similar to each other, so we did not include a comparative analysis of teams in the results.

## RESULTS

Figure 2 presents a preliminary theoretical framework induced from the analysis of the interview data. Consistent with the research methodology, the framework was derived inductively from the coded data and is supported by specific quotations from the interviews, as presented below. The framework shows that the demands of the virtual cross-functional team led to communication practices, including face-to-face communication and remote communication mediated by a variety of technologies. Through communication, team members learned various aspects of practice. They developed means for choosing and using appropriate technologies, for adjusting to differences in work pace and timing, and for meeting customers' needs. Collectively, their learning was situated in a community that was largely virtual but nevertheless capable of developing practices that its members found useful. New members were socialized to these practices over time.

----Insert Figure 2 about here----

We now present the evidence supporting the framework in Figure 2, using the main elements in the figure as an outline for organizing the results. To identify quotations from

respondent interviews, a first letter (N or S) designates the North or South location, and second letter (M or T) designates the respondent's role as a Manager or a Team member.

**The Demands of Virtual Teamwork**

It was expected that both workers and managers would regard virtual teamwork as novel, which in turn would produce the need for learning. For most participants, virtual work was seen as a change from normal, but for some it was the only work arrangement that they had known. Without more traditional work arrangements as comparison, one younger worker did not consider virtual teamwork unusual. However, both old and young workers acknowledged the demands posed by virtual work.

One North manager considered the need for cross-functional coordination to be more demanding than the novelty of the teams. That need had existed even before the people from different functions were organized into virtual teams:

> I have always thought that it was nothing that revolutionary…We were set up this way already with sales and administration. That is sales support functions here and operations and customer services [in the South]… I mean, you still have, obviously, on this side a sales person with a set department, a certain set of accounts, his or her support here in the North, and then down South you have an operations manager who basically mirrored your accounts, and your point of business and customer services, and production planners who just about do the same thing. NM

Managers did, however, describe differences in how they managed, needing to trust the team members more than in the past. For example, a South manager remarked:

> Traditionally all those years, especially for longer term employees, is that this is for real and you need to step outside what you were used to. They used to be told, and now we are asking them to think and the old statement of thinking outside the box. You are asked to be innovative. SM

This greater responsibility was confirmed by a South team member:

> We pretty much are our own boss as far as our time and what goes on in our areas. ST

The changing nature of work was also demanding for team members. A North team member remarked:

> The team is very exciting because it changes from day to day. You don't ever know what is going to happen next. ST

Demands were clearly related to the distance between team members located in the North and South. A North team member who was relatively new to the company commented on her adjustment to working with remote South members:

> It was kind of strange at first because I had been talking to them a lot on the phone, but I hadn't seen anyone or met anyone yet. So it was good once we were able to meet each other, connect faces to voices. NT

A South team member agreed:

> Yeah, it is really interesting having half of your office in a totally different state and the other half here. But the functions are related, but they are totally different. ST

In sum, both managers and workers felt new challenges: the need to communicate over distance, and the need to take more initiative in solving problems rather than turning to managers for direction. Most respondents generally viewed these challenges in a positive way, but collectively they represent demands on the team and its members. How they met those demands was the primary focus of other questions in the interviews, and the following comments about communication show the extent and nature of its importance.

## Communication

Both team members and managers mentioned communication as a primary means of meeting the demands of working in virtual cross-functional teams. Managers spoke abstractly, yet fervently, about the need for communication. Workers found ways to improve communication on their own, setting up specific arrangements with remote counterparts. We sorted communication into three types: improving cultural understanding, task-related communication, and socio-emotional communication. Under communication, we also present results about the uses of various technologies in remote communication and the role of face-to-face meetings.

*Improving cultural understanding* At a superficial level, team members from the North had to learn literally how to comprehend the thick accents of their southern counterparts. A North team member explained:

> It was a different accent. You know, because they have a down-south accent. And then I picked that up, and I had to get used to hearing it. And some of the slangs and stuff like that. So, I have never lived down south. I have lived in New York most of my life. NT

This superficial problem was symptomatic of a perception on the part of many that there were difference in the abilities of North and South workers. A South manager explained:

> There was a perception that if you were from south of the Mason-Dixon line that your IQ was about 50 points below everybody from above just because of the mannerism and the way we speak and the grammar, those type things. That was something that was thrown out at one of the team meetings that the folks in the South said that they felt like those from the North act like we were not capable of doing some of the stuff. Yet all the administrative functions fall on the South to do, so if you don't think we're capable why do you keep asking us to do it? What it is is that we are not smart enough to tell you no. So there was some growing on both sides. To give you another example, the folk in the south say 'no, sir' and 'yes, ma'am.' That's the way we were raised. It doesn't matter whether you were 50 years old or what. They looked at that as if we were trying to be subservient. But it's not. That's just manners. SM

Thus, communication among team members needed to respect linguistic conventions and overcome the stereotypical expectations often associated with cultural differences.

Improved cultural understanding allowed workers to coordinate their activities more effectively. A North manager explained how cultural differences affected the coordination of work schedules between North and South:

> I have to realize that they are on a much more structured schedule. They come in, there is a lunch time, and they leave at a reasonable hour. And our day is much longer. But I have a tendency to look for people at lunch hour, cause I sit at my desk, you know, most of the day. I have to be aware that they are entitled to that time spot. Because sometimes I am looking for people at the wrong times, you know, in the evenings. For the most part, if you call down and they are not at their desk, they are calling you right back. NM

In this example, the appreciation of cultural differences was not simply a matter of greater understanding. It also led directly to practices affecting work scheduling and performance. Other workers described systems that they had developed with their remote counterparts to improve communication, such as the making of checklists or the scheduling of regular phone calls. The next group of practices deals directly with task-related communication.

*Task-related communication* One important example of task-related communication was a Southern manager's realization that he needed to request more resources from his superior in the North.

> I reckon I wasn't vocal enough, that I wasn't sure one operations manager could handle all of the responsibilities of the group. But anyway once I made the point to him that maybe there wasn't enough of me to go around and that was affecting my performance level, within three days he had gotten approval for us to hire another operation's manager. That helped a lot. Just the fact that we had opened that dialog. I started realizing then, and I later even told him, that for me to get what I need I had to tell him what I need. SM

In this case communication was important to his future success at SoftCo. because without resources, he could not perform.

In another case, a Southern worker explained how her better communication skills made her more influential than other workers on the team. She said:

> And it is kind of split between the North and here. Sometimes our boss knows things that he doesn't really tell us about. He assumes, okay, well they will know this. But unless he tells us, a lot things we don't know. And with the North, my communication would be a lot better, I guess, if I made more trips to the North. But, I don't want to do that. …I guess I am a good communicator. I guess that is probably it. Between me and Carol, we probably inform the team as a whole, including salesmen and the North, better than anyone else. Because we know the repercussions if we don't inform them. It causes us problems in the very end. ST

This comment shows that in an empowered team, which receives relatively less direction from its manager, communication channels must be opened and used effectively for the team to perform. Clearly, this worker and others we spoke to realized the importance of clear communication to task performance. As shown below, communication also improved the social and emotional relationships among workers in remote locations.

*Socio-emotional communication* We were told several stories about workers extending social and emotional support across geographic and cultural boundaries. The best example of this was reported by a female team member in the North who had assumed a mentoring role with workers in the South. She explained:

> Like with the people down South, it is like every time you pick up the phone, somebody is usually depressed because they are overloaded. And I just feel that since I have been working with this department and with my team, no one has been happy, honestly. I have to honestly tell you that. No one is happy…. No one is listening to these little people. Maybe they are and there is nothing else they can do for them down there. I don't know. I don't know what I can do because I am overloaded

> myself….I mean, I try to cheer them up. I try to ask them, you know, 'Is there anything I can do to help from up here?'
>
> And then there are times when people are stressed and you just tell them like anyone else, you know, what is going on? And then they tell you. Either they are sick or, you know, their husband, or I am dating this guy. And I am like, oh, yeah. You can tell in people's voices once you get to know them whether they are happy. And I am like, oh, what happened? I have very good relations. I am really friendly, honestly, I get along with like everyone. I really don't have a problem with anyone. NT

This description conveys the degree of intimacy achieved with remote communication that spanned functional, geographic and cultural divides. This worker explained that she did not have time to visit the South location as often as she wanted to, but she clearly stayed in touch with her counterparts through other media. The next section provides additional findings about the use of media in communication.

*Remote communication media* Communication within virtual teams at SoftCo relied upon a variety of media including telephone, voice mail, fax, email, videoconferencing, and face-to-face meetings. There was no dedicated collaborative technology or groupware in place, so team members and managers mixed the available media to satisfy their needs. Choices among media were based on numerous considerations: urgency, individual preference, need for documentation, and ease of use. Each respondent, however, seemed to apply these criteria in different ways, supporting our expectation that communication practices would develop to meet locally understood needs. For example, a Northern manager explained his preference for email when communicating with someone he described as a particularly difficult employee:

> I have a tendency to communicate with him by email. I have no problem picking up the phone and calling anybody else. It is because I don't want to deal with the issue of him getting upset. NM

Several other practices illustrate the creativity and complexity of media choices. In one case, a Southern team member described how she used the telephone when she was away to contact another worker who would read her email.

> I have a girl that works for me, and she can get into my email and she can check my email to see if there is anything real important. If you don't have a laptop, you can't just go to another office and check your email or make sure, unless you are set up on their computer. And I am set up on the computer in the North also. So I could check my email while the North. If I was in Atlanta, though, like I am going to be tomorrow, I couldn't check my email. So the girl that works for me, she checks

> it. She has my password and she can get in and check it. And usually, she and I are getting the same email. ST

In another case, a southern team member explained how data were shared. Rather than accessing a shared database, which was available on the company's mainframe in a public folder, workers called each other or attached spreadsheet files to their email messages.

> We have different drives where there are public folders, and you can go in and look and see. Like I do a report, it is a blanket, where we actually purchase material and we purchase it like six months at a time and they give us a certain price, a certain delivery. And that is out there on a part we call the H-drive. And anybody can go in and look at that. ST

When asked if the shared databases were consulted, this same respondent admitted:

> No. Uh-uh. Not for my stuff. I am sure they do for other things. They probably do for, you know, for other stuff that really relates to them. This relates to them too, but they usually just pick up the phone and call me. I remind them about it every time they do that. That it's there and how to get there. But, I guess they just feel like it is easier just to pick up the phone and call and ask. ST

These explanations show that different technologies were used in inelegant yet innovative ways, often to compensate for difficulties in accessing or using available media. A team member from the North explained one reason for the practice of avoiding shared databases:

> [The mainframe] is a good system in some respects, but it is fragmented. I mean, you can go from this screen to that one and it kind of like drives you crazy. And then you take the information and you wind up putting it on an Excel spreadsheet. This is okay, but this takes a lot of time. But I think that one of the other great things is that we pretty much all have our own laptops. You find yourself taking it home. You take it home on the weekends. NT

A North manager confirmed the practice of producing spreadsheets from mainframe data, attaching them to email messages, and updating and returning them:

> When I send out monthly statements, I do it on an attachment from Excel. And everybody has Excel, whether it is on their computer. And that is how I send it out in email. I hardly send out paper anymore. They are all attachments.

In addition, videoconferencing was used frequently. In one North manager's assessment, videoconferencing added personal presence to remote communication:

> [Videoconferencing] would be used to kind of bridge the gap and somewhat make it a little bit more personal interaction, but it is not used as broadly as or as often as we probably should and we like. NM

In both the North and South locations, rooms equipped with videoconference facilities were available, although we did not have the opportunity to observe them in use. In fact, the room used in the North for our interviews was a room normally reserved for videoconferences.

Although many of the communication practices described may appear to be inefficient, and perhaps a threat to data integrity or security, they had evolved over time in the teams and seemed to satisfy people's needs to communicate remotely. Next, we consider the role and importance of face-to-face communication.

*Face-to-face communication* Face-to-face communication occurred through two primary means: business meetings involving travel by individual workers in both directions between North and South, and quarterly team meetings involving all team members from both locations. Although business travel was time-consuming, several workers commented on its value. A South manager noted:

> It's just better to let people meet face-to-face. When you just talk to somebody on the phone it's just fine, we just feel it's effective, but it doesn't really have a big impact. I mean, because our North staff is not that big compared to some of the other areas -- we only have about five people up there -- and they don't mind coming down here. They kind of like it, and the people down here don't mind going up there so. That's one good thing. They enjoy going up there. SM

A South team member described what business travel was like.

> Yeah, when they come, they come over and sit at our desks and use our phone, or whatever. And we go to dinner, lunch, or whatever. You know, we are pretty close when it comes to going out. When the girls go up there, they all spend time together. It's a real togetherness thing. It's not like you go up, you go to a meeting, you go to your room, you never see them again. Everybody get along well. And we have fun on those kinds of going-out-of- town things. You know, we all go to dinner and everybody, you know, cuts loose, and have fun, or whatever. It's not just all work. And you have gotta have that or you wouldn't get along with anybody. ST

The other form of face-to-face meetings were periodic business meetings, usually held at locations such as golf courses, beaches, or mountain resorts. The normal format was to mix business with social activities over the course of two or three days, but the exact format varied across teams. A new North team member described the experience.

> So with the three or four meetings, we accomplish more in those two days than we can accomplish here in like two weeks. So then it pays. Like we are having the same issue back and forth. And if we just bring those copies that we have and resolve them there, then it goes quicker while we are there.

> Maybe something is getting lost from the time of here to there, when we are emailing or on the phone. But when we are face to face, it is quite simpler… That's because, there you see them in a different environment than normally, not in the office. It is outside. And it was in a resort so people were more relaxed. They were eating dinner with some people that I normally would not normally eat with. So it was different. NT

Remote and face-to-face communications were frequently combined in ways that satisfied individual preferences and task needs. By traveling to each other's sites and to the quarterly meetings, workers at SoftCo gained respect for each other as people. The closer interpersonal relationships helped them to devise mutually compatible procedures for using remote communication technologies to accomplish their shared work so that customers were satisfied and performance goals were met. Communication in its various forms both produces and reflects the practices that the teams learned. In the final part of our Results section, we report further on the outcomes of the communication processes within the teams.

## Learning Situated in Practice

We use the active verb form "learning" here instead of the noun "knowledge" because we understood knowledge generation to be ongoing and dynamic. Thus, what was learned through the complex communication practices described above was not static. Because it was situated in practice, learning continued to evolve. We invited everyone we interviewed to provide examples of practices that they had learned, and most reports included descriptions of how that learning continued. Some of these accounts pertained to learning between co-located workers, sometimes from different teams. Others involved learning between remote members.

Co-located learning was important to virtual teamwork because it oriented new workers to the special demands of remote work. For example, a South team member explained how she taught her skills to the most recently hired customer services person.

> She sat with both Donna and I and caught on really quick. I mean we went over everything, but she pretty much watched us do the work and then just caught on like that. To me that is the only way that you can learn what we are doing. It helps to know, like when I would get off the phone, I would say, 'well he called and wanted to place a personal use order and this is, you know, how you give a discount and these are the screens that I went into.' So you try to sort of walk them through it, let them know what the customer wanted. ST

Managers appreciated this mode of learning through watching experienced workers and explaining what was done. A South manager explained:

> You know, they will always try to ask a neighbor. And that is something that our team does. Instead of just calling to me every time, they will ask the person sitting by them. 'Well, what do you think? Do you think that we should give them this?' And there's a lot of communication going on within customer services. SM

These accounts of learning include the visual, tactile, and verbal communication processes that co-located workers enjoy. For both managers and workers learning across locations, different processes were engaged. One South manager described the challenge of getting more resources from his boss, who was located in the North:

> In the case of somebody being in the office a lot of the times, I was used to him knowing what I wanted just from visually seeing what's wrong. But when you are 1,000 miles away they can only go by what they hear, and you have to be more verbal about what you need and what you don't need. In this case I needed help and didn't have it and I was expecting him to know without telling him…. Now I have learned…that if you deal effectively with your boss as well as your subordinates, you've got to tell them what you expect. That's not a concept I'm used to, and maybe that's my southern raising. I'm used to my boss telling me what to expect and knowing what I need and telling me here's where we go. It was more that I had to take a proactive role in directing the actions. This was something I had to adjust to, so that was not all his adjusting. SM

Although it may seem obvious that a remote boss cannot see your needs, the manager was quite candid about the difficulty in making this discovery.

In our descriptions of communication practices above, we mentioned cases where workers learned to appreciate the differences in work pace between the North and South locations. To illustrate how such differences were recognized and resolved, we include comments from an extremely animated Northern team member:

> It is not hard for me to want to go 75 and 90 miles an hour. And I think that I had a hard time coming to grips with the fact that maybe those people really aren't going to go but 45 miles an hour. And I had no problem just jumping right down their throats. And all of a sudden, it was like, this is not the way to win friends and influence them. 'Cause, you know what? I am going to get nothing out of it. So, you just have to take a step back, and then I realized that there are times that I just have to take a big deep breath, and make the phone call and say, 'Let's work our way through it.' NT

When asked if the people in the South had made adjustment to her, the North team member replied:

> No. I have made adjustments to them. I will admit that, you know. It has been more one way than the other. I know that they know that there isn't anything that I wouldn't ask them to do that I wouldn't do myself. And they know that if it takes staying until 7 o'clock, 10 o'clock, coming in at 5 o'clock in

> the morning, seven days a week, I am right there. So it is like, they know that I would never ask them to go any extra that I wouldn't be there going the extra too. NT

Another North team member, who described a difficult relationship with her Southern counterpart, confessed that she had come on too strong:

> I used to haunt her to death. That could have had a lot to do with the way our relationship developed. I used to haunt her to death. I used to call her 50 times a day. 'How do I do this? What do I do?' NT

This worker continued by explaining a recent incident:

> You know, sometimes I guess my sense of urgency, sometimes, isn't like her sense of urgency. You know, I had a problem the other day, and I said that when she finds that information she has got to tell me. Because we are able to fix it up here sometimes better than in the South…. And I asked when did she find out the information. And this just happened when I got in Monday. She said she found out on Thursday. And I said to her: 'You have to let me know something happened on Thursday when you are discussing it with somebody else. I have got to know that day.' NT

Situated learning was also illustrated by the relationship between customer service people located in the South and remote sales people, who traveled regularly and were hard to reach. A customer service person explained:

> Well, we have a salesman that I will be seeing tomorrow and I can't wait to get there. I have a few things to discuss with him. A problem with him is that he travels a lot. And we get a lot of his phone calls that we know nothing about. I mean, I will take any call, but I want to know some up front information. I don't want somebody to call me and say, 'Hey, Jake Harper told me to call you regarding blah blah blah.' And I am like, Okay. And I don't have a clue. If somebody tells someone to call me, they should at least say, 'Okay, you are probably going to get some phone calls regarding this, this, this.' But, you know? I get blind-sided a lot when it comes to him. But I deal with it. I am going to say to him, 'you know, I need a little help here. I don't think that is fair to me just to drop your work on me and not even let me know it going to come.' He and I sort of have a love-hate thing going on. We let each other have it. But it works out. ST

The customer service worker explained how hard it was to "train" a salesman:

> It is hard to train a salesman that is not here and doesn't know what you are looking at. I mean, he may send in an order and expect you to ship tomorrow. Well, that's not going to happen. I mean, you have got to do a lot of day-to-day training with your salesmen. You know, 'this will work better for me and I think it will help you too if you fax it in. You know? And we can't turn an embroidery order in 24 hours.' Those types of things that you have to learn as you go. ST

These excerpts show that adjustments to work schedules and expectations were made after workers experienced difficulty establishing mutually acceptable work practices. In each case, the resolution was produced directly by the persons involved, rather than imposed from the outside. By

situating their learning in a virtual community of practice, the workers both resolved specific problems and laid the groundwork for continued learning.

Finally, one incident described by a South manager revealed how the virtual teams exercised social control over team members who violated practices that the team had learned. In this case, the issue involved a team member who used email to expose a fellow team member's mistakes to everyone, including higher-level managers. The manager used this story to illustrate how teamwork was different than traditionally organized work, and how such behavior could not be tolerated.

> We have one person in there that has been there a long time, who last week showed highly visible signs of being a little more for their own interest and taking advantage of the situation to make themselves look better. Now, that person was severely chastised. And I say chastised. What happened was, they were in this situation where another member of the team had made a decision for the benefit of the company and the email consisted of pointing a finger at that person: 'Somebody needs to go down and bust their ass, bust their butt.' I said 'whoa, whoa, watch it. What do you mean there?' And this was to the higher ups. And I can't tolerate that. Because that is a clear sign then of saying: 'Hey, look at me. I am doing great. But that dummy done wrong.' And that was not tolerated. SM

## DISCUSSION AND CONCLUSIONS

By using an interpretive approach, we have drawn ourselves closer to the experience of work in cross-functional virtual teams. We have reported personal accounts of how members adjusted to demands of a virtual team environment, how they communicated both remotely and face-to-face, and how they learned new practices to accomplish their work and satisfy their social needs. By extending the concept of community of practice to include virtual communities, we are able to focus on communication and learning practices and the consequences they bring to team members. Although working in virtual teams permits infrequent face-to-face communication, learning can be effectively situated in virtual space. The framework describing our results may guide further research, which would be expected to produce useful elaborations of the concepts that comprise the framework and greater understanding of the relationships among concepts.

There are a number of implications that can be drawn from this study. The teams at SoftCo demonstrated great resourcefulness in solving problems and finding a mixture of communication

media to support the learning of work practices. The creative accommodations and adjustments that were described are evidence of how work practices can emerge as a product of community interaction. The practices devised to coordinate work pace and work schedules succeed because they respond to local needs. Learning how to work virtually is indeed situated in practice rather than imposed from above or from the outside. Managers of virtual cross-functional teams need to understand this and use a “hands-off” style that empowers team members. SoftCo’s workers responded to their greater responsibility by improvising work practices that met their needs. It is doubtful that managers could anticipate every team need and develop formal work practices to guide team members.

Managers do, however, need to support virtual teams with appropriate rhetoric, reward systems, and technologies. They also need to stage opportunities for face-to-face meetings. Respondents were overwhelmingly positive about the quarterly meetings that gave them chances to meet each other. The fact that these were held in attractive locations, and that no team members were excluded, contributed to their value. Workers also seemed able to manage their own level of business travel, so that Southern workers who enjoyed trips to the North could go more frequently. Team members felt empowered to mix remote and face-to-face communication using their own recipes. Incentives were also used to motivate team performance, and team members were well aware of the sizeable bonuses that came from satisfying customers.

The role played by information technology in SoftCo’s virtual teams is consistent with our conclusions about situated learning and empowerment. SoftCo’s team members relied upon a variety of communication technologies: telephone, fax, electronic mail, and videoconferencing. These rudimentary technologies were used in creative ways to satisfy communication needs. By contrast, much attention is currently placed on the design of special collaborative technologies to support virtual teams (Rittenbruch, Kahler, and Cremers, 1998). From the theoretical perspective of learning situated in virtual communities of practice, the imposition of a special collaborative

technology effectively restricts members' choices of media. Virtual teams, as communities of practice, may be more effective if they are not constrained by technology, no matter how elegant or powerful it might be. While both team members and managers were aware of the limitations of the technologies available to them, they creatively overcame many of those limitations by combining media, even though such practices introduced redundancy, security and privacy concerns.

Our findings clearly show the value of face-to-face meetings in establishing a greater social connection among team members. Workers frequently mentioned the value of "putting a face" on their remote counterparts, and they used this knowledge to greater advantage when communicating remotely. Socio-emotional communication typically began during face-to-face visits connected with business travel or at quarterly business meetings and was sustained electronically after these meetings. Members appreciated these opportunities to meet their counterparts in person, partly because such meetings were instrumental to accomplishing their mutual tasks and partly because of the social benefits of getting together. Designers of virtual cross-functional teams should try to devise means for both remote and face-to-face communication to occur.

Because our approach was interpretive, we are limited in our ability to generalize to other settings. Our findings incorporate the subjective responses of participants in one particular, socially constructed world of work, which may differ from the worlds of other workers. However, a benefit of the interpretive methodology is that it extracts detail that might be masked in a survey targeted at a larger sample. Our respondents talked at length about learning and communication, bringing these abstractions to life in their own words. We imagine that other virtual cross-functional teams would be similar in some ways while sustaining distinctive characteristics of their own. The implications developed here reflect an awareness of virtual teams as distinct communities, capable of learning their own particular practices. However, we expect that the processes of learning and communication described here would occur in some fashion in every virtual team faced with the

need to coordinate across business functions. Consequently, the framework describing our results (Figure 2) has general value beyond the value to SoftCo managers and workers.

In conclusion, we have presented, mostly in the voices of team members and managers themselves, how learning occurs in virtual cross-functional teams. Like co-located teams, members of a virtual team comprise a community of practice. Using available resources, they develop practices that reflect their unique needs, both task-oriented and social. They create and share knowledge and socialize new members to team practices. Their learning is situated in practice, even though their situation is one that spans geographic boundaries and cultural divides. Not only do these findings provide implications for the management of work in virtual teams, but they also reinforce the value of viewing work, even virtual work, as a community of practice in which learning is situated.

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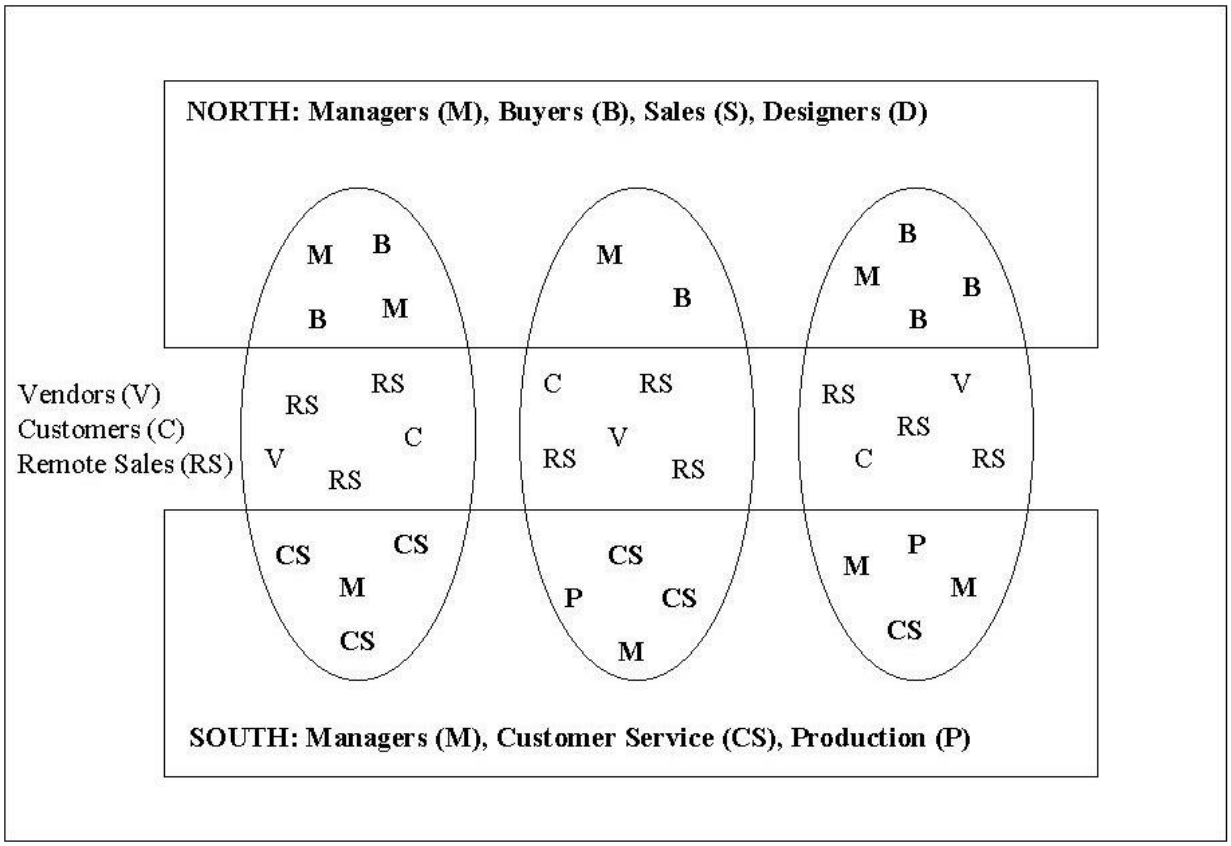


Figure 1: Configuration of Virtual Teams at SoftCo

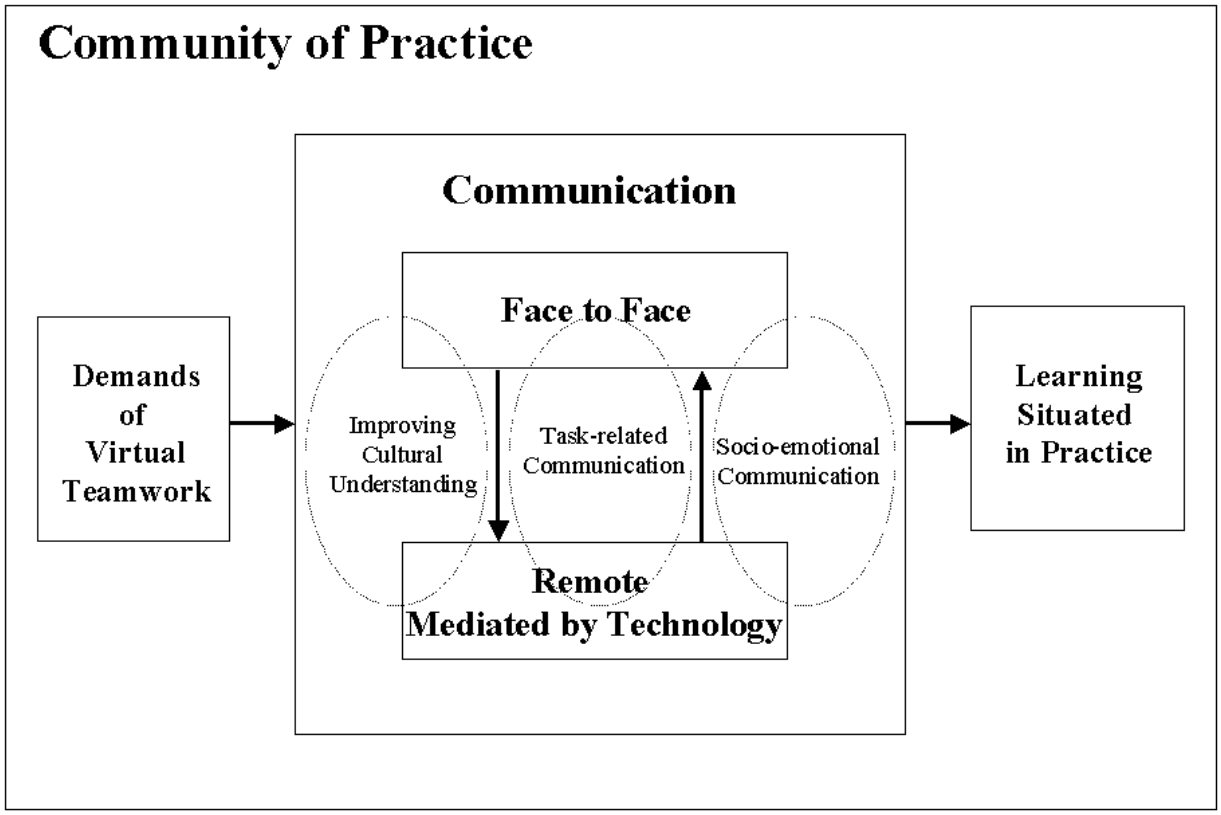


Figure 2: Framework for Situated Learning in Virtual Teams

BIOSKETCHES

Daniel Robey holds a joint appointment as Professor in the Departments of Computer Information Systems and Management at Georgia State University. He received his doctoral degree in Administrative Sciences in 1973 from Kent State University. He is currently a Senior Editor for *MIS Quarterly* and an Associate Editor for *Accounting, Management and Information Technologies* and *Information Systems Research*. He also serves on the editorial boards of *Organization Science* and *Canadian Journal of Administrative Science*. Professor Robey is the author of three books and numerous articles on the organizational consequences of information systems and the processes of system development and implementation.

Huoy Min Khoo is a doctoral student in CIS department at Georgia State University. She received her M.B.A. from Mississippi State University and B.S. in Computer Science from University of Mississippi. Prior to joining the doctoral program, she worked in the IT industry developing reporting systems and managing databases. Her current interests are in virtual organizations and electronic commerce.

Carolyn Powers is an independent consultant specializing in business process re-engineering and web site development. Previously she worked as Director of Application Development for a *Fortune* 1000 manufacturer and importer. She has also worked as a manager for Andersen Consulting. She received her BS in Mathematics from Emory University, her MBA in Accounting from the University of Cincinnati, and completed one year of doctoral studies in Computer Information Systems at Georgia State University.