THE INFORMAL WORKPLACE LEARNING EXPERIENCES OF VIRTUAL TEAM

MEMBERS: A LOOK AT THE ROLE OF COLLABORATIVE TECHNOLOGIES

by

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ABSTRACT

In the developed world, technology has become an essential component of the vast majority of jobs and therefore a fixture in the lives of most workers. Technology's impact on work is especially powerful for *virtual* work teams, a growing segment of the work population, who depend substantially more on information and collaborative technologies than co-located teams (Gibson & Cohen, 2003). The purpose of this qualitative interview study was to explore how collaborative technologies influence the informal learning experiences of a diverse group of twelve virtual team members. Inputs revealed in this study as critical to setting the stage for virtual informal learning are integrated, collaborative technological systems; positive relationships and trust; and organizational support and virtual team management. Having these inputs in place fosters the processes and events within which informal learning occurs. Those processes are learning from and with others and occur during events of virtual mentoring, coaching, knowledge sharing, criticism, problem solving, document creation/editing, and planning.

INDEX WORDS: Informal Learning, Workplace Learning, Virtual Teams, Collaboration, Technology, Qualitative Research

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DEDICATION

I dedicate this dissertation to my mother, Marva Joyce Jones, who has graciously and

lovingly provided me with unrelenting support and encouragement during this process.

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CHAPTER ONE: INTRODUCTION

Introduction

In the developed world, technology has become an essential component of the vast majority of jobs and therefore a fixture in the lives of most workers. Consider the following quote from the Center for Work, Technology, and Organization's (WTO's) web site (WTO, 2002): "We spend over half of our lives working. Work defines our identity and social status, gives us purpose, and shapes our social network. Work is also the basis for all organizing… In organizations, work gets done through technology." Technology's impact on work is especially powerful for *virtual* work teams, a growing segment of the work population, who depend substantially more on information and collaborative technologies than co-located teams (Gibson & Cohen, 2003).

Technology not only often serves as the primary means by which virtual workers interact and collaborate, but also how they learn during work. Marsick and Watkins (1990) theorized about the presence of learning in the workplace when they wrote that "…people learn in the workplace through interactions with others in their daily work environments when the need to learn is greatest" (p. 4). Despite their claim and the impact of technology on virtual work, the connection between learning situated in the everyday experiences of work and technology's facilitative role, especially among virtual workers, has yet to be thoroughly investigated by researchers.

Studies examining the interplay of technology and work (e.g., Coovert & Thompson, 2001; Grudin & Poltrock, 1997) as well as the interplay of technology and learning (e.g., Kirschner & Van Bruggen, 2004; Schenkel, 2004) exist, but few

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specifically seek to examine the intersection of the three entities: everyday work activities and interactions, technology, and learning. Such an examination is a worthy endeavor, considering how organizations are increasingly adopting the virtual team model and relying on technology to facilitate virtual team collaboration and learning. Research is needed to build foundational knowledge about the effects of work, learning, and technology on virtual team members. This new knowledge may be of value to organizations as well as the individuals who work in them.

Background

Virtual Team Work

Most research in the last 15 years devoted to virtual teams has revolved around two topics—computer-supported cooperative work (CSCW) and virtual team member relations. CSCW research considers technology's effect on virtual work, primarily through investigations of group decision support systems (GDSS), groupware, and other collaborative technologies. Research findings have shown that, in practice, technology has not been an overwhelming success in supporting collaborative work (Andriessen, 2003; Coovert & Thompson, 2001; Grudin & Poltrock, 1997). Studies have identified a number of technical and social/organizational challenges that jeopardize the success of virtual teams that use technology to complete organizational tasks. One challenge that has surfaced in a number of research studies is the ability of virtual team workers to build relationships with one another via technology. Relational aspects such as team psychological safety (Edmondson, 1999), trust (Hoag, Jayakar, & Erickson, 2003; Jarvenpaa, Knoll, & Leidner, 1998; Jarvenpaa & Leidner, 1999), effective communication (Hightower & Sayeed, 1995, 1996), and mutual knowledge (Cramton,

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2001) have been shown to be important factors in virtual team success, but these studies also acknowledge that these factors are often lacking among virtual team members.

Workplace Learning

What is often overlooked in the virtual team literature is not only are teams working, they're learning while working — learning as they adapt to virtual team processes and routines, learning as they construct individual and shared knowledge, and learning as they adapt to technologies designed to enable learning and collaborative processes. According to Bitter-Rijpkema, Sloep, and Jansen (2003), these types of formal and informal learning are important to high performance professionals who are also permanent learners. Today's professional work requires that professionals learn to creatively use available knowledge and experiences to develop innovative solutions. Traditional approaches to professional learning and development, such as training sessions and performance support, neglect to facilitate "the learning required for collaborative, creative problem solving, learning to work with new methods and tools, and organizational learning" (Bitter-Rijpkema et al., 2003, p. 19). Scholars, such as (Resnick, 1987), have argued that learning should not be restricted to formal education and is best situated in authentic tasks performed in daily life and work. Brown and Duguid (1991) further advocated that work, learning, and innovation can and should be unified:

> Much conventional learning theory, including that implicit in most training courses, tends to endorse the valuation of abstract knowledge over actual practice and as a result to separate learning from working and, more significantly, learners from workers…knowledge-practice separation is unsound, both in theory and in

practice. We argue that the composite concept of 'learning-in-working' best

represents the fluid evolution of learning through practice. (p. 41)

A handful of researchers have investigated planned, organization-driven learning

that occurs in the context of virtual work. E-mentoring (Bierema & Merriam, 2002),

knowledge-sharing and management (Herrmann, Kienle, & Reiband, 2003), and

computer-supported collaborative learning (CSCL) (Kirschner & Van Bruggen, 2004;

Kreijns, Kirschner, & Jochems, 2002; Kreijns, Kirschner, Jochems, & Van Buuren, 2004)

are a few examples of research topics undertaken to explore the integration of work and

learning and its influence on learning and performance. This set of studies, though small,

provides a foundation for understanding the importance of situating learning in authentic

work-based tasks.

Informal Workplace Learning

While researchers have begun establishing a body of research for formal

workplace learning, informal workplace learning as a purposeful research focus remains

in a state of nascence despite the assertion of theorists and researchers like Marsick and

Watkins (1990) who stated: "The potential exists to help people learn more effectively in

the workplace by focusing on real life rather than on prescriptions, examples, and

simulations" as is usually found in traditional training sessions (p. 4). Findings from a

two-year research study conducted by the Education Development Center, Inc. (EDC) in

1997, which investigated informal learning in a number of major corporations, support

Marsick and Watkins' statement. The EDC found that "70 percent of what people know

about their jobs, they learn informally from the people they work with" (Cofer, 2000).

In light of this statistic, it is ironic that in advanced industrialized countries most research and theory development related to learning has been centered on formal education and training (Colley, Hodkinson, & Malcolm, 2002), especially when you consider the number of prominent scholars who have acknowledged the disconnect between what is learned in formal education/training settings and what is learned in practical life (e.g., Brown & Duguid, 1991; Lave & Wenger, 1991; Orr, 1996; Resnick, 1987; Rogoff & Lave, 1984). While there are a small number of research studies that consider informal workplace learning (e.g., Grolnic, 2001; Howe, 1991; Maben-Crouch, 1997; Wagner, 2001), more are needed to reveal the benefits of informal workplace learning and to discover ways to maximize those benefits. There is also a great need for studies that explore informal workplace learning in the context of virtual teams. Considering the proliferation of virtual teams it is important to examine how interaction and collaboration via technology enhance or inhibit the informal learning processes of virtual team members.

Purpose Statement and Research Questions

The purpose of this study was to explore how collaborative technologies enhance or inhibit the informal learning experiences of virtual team members. The following questions guided this inquiry:

1. How do virtual team members describe their informal workplace learning experiences as facilitated by technology?

    a. What are the perceptions of collaborative technologies among virtual team members?

b. How do collaborative technologies facilitate or inhibit informal learning among virtual team members?

2. What cognitive, social, emotional, motivational, and contextual variables affect the informal learning of virtual team members? How do collaborative technologies impact those variables?

a. How do team psychological safety, trust, and mutual knowledge relate to informal learning in the context of virtual work? What role do collaborative technologies play in supporting those relationships?

b. How does the organization support or inhibit virtual team member learning that is informal and enabled by collaborative technologies?

Significance of the Study

The overarching goal of this study was to *explore* the phenomena of informal workplace learning; therefore it is categorized as interpretive (Patton, 2002). I employed the qualitative method of interviewing to gather data addressing the research questions from twelve participants. Qualitative research has limited generalizability (Merriam, 2002), but the results of this study may be useful, especially when combined with similar studies. From a research perspective, this study provides a unique contribution to the virtual team and informal workplace learning literatures as it integrates the two topics and purposefully considers technology's impact on virtual work and learning. When combined with the results of other studies, the study's findings also help to inform the research of academics in a variety of disciplines, especially those interested in the intersection of instructional technology, performance technology, information and communication systems, and human resources development.

From a practical perspective, this study provides information to organizations that have virtual teams and to collaborative technology developers as to what activities and enabling tools facilitate informal, virtual learning processes and outcomes. It also reveals a number of best practices for virtual team success. The success of virtual teams is critical considering the following conclusion drawn by Duarte and Snyder (2001): "organizations that do not use virtual teams effectively may be fighting an uphill battle in a global, competitive, and rapidly changing environment" (p. 3).

Researcher Assumptions and Beliefs

When the researcher is also the interviewer, as was the case in this study, the likelihood that biases and/or assumptions may affect the selection of interview participants, the selective attention to details, and/or the selective interpretation of data is increased (Merriam, 2002). In some cases, biases and/or assumptions can add value to data collection, analysis, and findings; in others, they can be a limitation. It is up to the reader to critically evaluate the research and the stated biases/assumptions of the researcher to determine if they are a hindrance or strength.

For purposes of my study, it is appropriate to inform the reader that I assume technological tools can be used to enhance learning. I have advocated the use of technology in various educational settings, such as K-12, higher education, and workplace learning. I have a master's degree in Instructional Technology, and I am conducting this study in partial completion of the requirements for a Ph.D. in the same field. Another assumption I hold is that people learn best when solving real-world problems in collaboration with peers.

Limitations of the Study

This study has several recognized limitations. They are as follows:

- I gathered data related only to technologies used by research participants.

- I focused only on *informal* workplace learning incidents, processes, and behaviors.

- A small sample size of twelve research participants limits this study's generalizability; however generalizability is usually limited in qualitative studies. Merriam (2002) argued, "A small sample is selected precisely because the researcher wishes to understand the particular in depth, not to find out what is generally true of the many" (p. 28).

- Time per participant was limited to one 60-90 minute interview. Such a time frame limits the depth with which I was able to analyze such a complex topic as informal learning in virtual teams.

Despite these limitations, this study generated useful insights as to how collaborative technologies enhance informal workplace learning among virtual team members for managers and workers in organizations that employ virtual team members similar to those in this study. The study may also stimulate further research in this area.

Definition of Terms

Three terms were integral to this study and are used throughout. They are: virtual team, collaborative technologies, and informal workplace learning. While definitions for these terms differ among researchers from varied disciplines, I have attempted to fuse together the more compelling parts of those definitions or to employ those supplied by well-recognized leaders in the respective fields of study.

Virtual Team

After reviewing 49 empirical virtual team studies dating from the time the term "virtual team" was coined, Dube and Pare (2004) remarked, "To achieve a better understanding of virtual teams, researchers must first agree on a common definition" (p. 3). In my review of literature, I have also found that common definitions are a rarity in the virtual team literature which spans a wide spectrum of disciplines. Scholars differ not only in the degree of virtuality that constitutes a virtual team, but also in their definition of team. While many scholars define virtual teams as "groups of geographically and culturally dispersed coworkers using a combination of communication and information technologies to accomplish an organizational task" (Andriessen & Verburg, 2004, p. 270), others deemphasize their geographic and cultural dispersion and define them as "a group of people who work interdependently with a shared purpose across space, time, and organization boundaries using technology" (Lipnack & Stamps, 2004, p. 18).

Dube and Pare (2004), however, criticize definitions such as these that overemphasis physical dispersion. They argue that workers may share a common location but be present at different times. What they insist is the defining characteristic of virtual teams is their *predominant* use of information and communication technology to "communicate, collaborate, share information, and coordinate their efforts" (p. 4). They also distinguish virtual teams from virtual groups, virtual communities, and virtual organizations by highlighting Katzenbach and Smith's (1993) assertion that what defines a team is their commitment "to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable" (p. 112). Considering all of these perspectives, I will use the following definition to guide this discussion: *a virtual*

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team is an interdependent group of individuals who predominantly use technology to communicate, collaborate, share information, and coordinate their efforts in order to accomplish a common work-related objective.

Collaborative Technologies

Various terms found in the literature are used synonymously to label technologies used by virtual terms. They are computer-mediated communication systems (CMCS), information and communication technology (ICT), groupware, teamware, collaborative information technologies (CIT), and collaboration technology. In an effort to emphasize the ongoing, collaborative aspect of a virtual team's use of technology, I will heretofore use the term *collaborative technologies* except when directly quoting sources that use a different term.

To illustrate the erratic use of terminology found in literature, Munkvold (2003) admitted that terminology of this type is transient in nature and will fade just as terms like "groupware" have. He also acknowledged the growing popularity of new terms like "e-Collaboration" and "c-Commerce" (p. 8). His definition of collaborative technologies integrates the essence of all the other terms and extends the scope of its use from team to organizational and interorganizational levels:

> Collaboration technology is defined here as all types of information and communication technologies that enable collaboration at various levels, from two persons co-authoring a document to interorganisational collaboration where several companies are engaged in common tasks. (p. 3)

Andriessen (2003) defined collaborative technologies as "those ICT applications that support communication, c-ordination, co-operation, learning and/or social encounters

through facilities such as information exchange, shared repositories, discussion forums

and messaging" (p. 10). This definition is also compelling because it mentions learning

which is appropriate considering learning can be an outcome of collaboration.

Although Andriessen provides a useful list of examples in his definition, it is

staggeringly incomplete when compared to Ferris and Minielli's (2004) comprehensive

categorization of collaborative technologies as shown in Table 1.1. Based on a

combination of the definitions by Munkvold and Andriessen and Ferris and Minielli's

typology, I will use the following definition of collaborative technologies to guide this

discussion: *collaborative technologies are all types of technologies that facilitate*

communication, collaboration, coordination, and learning at various organizational

levels.

Table 1.1 Collaborative Technologies

Category	Type	Examples
Messaging Systems	Asynchronous Computer Messaging Systems	E-mail, audio and video email (*Talk99*), electronic bulletin board (*InsidetheWeb*), discussion lists, weblogs (*Traction*), short message service (text messaging)
	Synchronous Computer Messaging Systems	Instantaneous interactive messaging (Lotus *Sametime*), chat systems (*WebTrain*)
	Synchronous Conferencing Systems	Proprietary conferencing packages (*NetMeeting*), videoconferencing (*Timbuktu Pro*)
Information Exchange/Data-Management Systems	Internet	File Transfer Protocol (*Netmanage*), *Gopher*, *Telnet*
	Internet Alternatives	Internet II, National Science Foundation's *Barebone Network Service* (vBNS)
	World Wide Web	Browsers (*Internet Explorer*), search engines (*Google*)
	Online Databases	Digital Libraries (New York Public Library)
Commercial (Proprietary)	Comprehensive Proprietary Groupware Packages	*Lotus Notes* and *Domino*, *Microsoft Exchange*, *Netscape Collabra*

| Groupware Packages | Specialized Conferencing Tool | *Groove Workspace*, National Center of Supercomputing Applications' *Habanero*, *Vermics*, *e-Studio Live* |
| | Representative Course Management Software | *BlackBoard*, *WebCT* and *Vista*, *ECollege AU* |

Note. Adapted from "Technology and Virtual Teams," by S.P. Ferris & M.C. Minielli, 2004, *Virtual and Collaborative Teams*, pp. 193-211.

Informal Workplace Learning

Finally, I turn to the difficulty in defining informal workplace learning as articulated by Colley, Hodkinson, and Malcolm (2002). Their review of the informal learning literature led to the discovery of 20 dimensions of difference among the definitions of informal learning used by various authors. After making this discovery, it became clear to Colley et al. that clear-cut boundaries of what is considered informal and formal learning is dependent upon the particular context being considered and the theoretical view of learning held by the writer.

To illustrate the fluctuation in terminology used within the literature, consider the definitions of the European Commission (2001) and Eraut (2000). Eraut chose not to use the term informal learning and instead used the term non-formal learning to represent any learning that is not prescribed, rewarded, nor facilitated by an external source. The European Commission used both informal and non-formal learning and made intentionality the distinction that separates their definitions. Their glossary defined the terms as follows:

- [Informal learning:] Learning resulting from daily life activities related to work, family or leisure. It is not structured (in terms of learning objectives, learning time or learning support) and typically does not lead to certification.

Informal learning may be intentional but in most cases it is non-intentional (or

"incidental"/random). (p. 32)

- [Non-formal learning:] Learning that is not provided by an education or

training institution and typically does not lead to certification. It is, however,

structured (in terms of learning objectives, learning time or learning support).

Non-formal learning is intentional from the learner's perspective. (p. 33)

In contrast, Billet (2001) rejected the terms informal and non-formal. He

described them as negative, inaccurate, and ill-focused and wrote that "describing a

phenomenon by what it is not: (e.g. informal—'not formalized', unstructured—not

structured) is unhelpful" (p. 4). He also argued that "although not intentionally stated in a

syllabus, the pathways of activities in workplaces are often inherently pedagogical, as

they focus on continuity of the practice through learning" (p. 5). He called for a

workplace pedagogy that acknowledges the intentional, participatory nature of workplace

learning.

Victoria Marsick and Karen Watkins are leaders in the area of informal workplace

learning (Cofer, 2000) and have, perhaps, the most well-known and respected definition.

In 1990, they introduced their conceptualization of informal workplace learning and its

importance by discussing the difficulty workers experience in transferring what they

learn in training sessions to their everyday work (Marsick & Watkins, 1990). While

acknowledging the value of formal learning via classroom instruction and advocating its

link to informal learning, they expressed their view that learning is more effective when it

is situated in a real life context. They defined informal learning and what they consider its

subcategory, incidental learning, as follows:

Informal and incidental learning both speak to learning outside formally

structured, institutionally sponsored, classroom-based activities. As a result, both

informal and incidental learning often take place under non-routine conditions,

that is, when the procedures and responses that people normally use

fail….Informal and incidental learning, however, are not exactly the same.

Incidental learning is defined as a byproduct of some other activity, such as task

accomplishment, interpersonal interaction, sensing the organizational culture, or

trial-and-error experimentation. As such, incidental learning is never planned or

intentional, whereas informal learning can be planned or intentional, as for

example, in self-directed learning or help consciously sought from coaches or

mentors. (p. 6-7)

In this study, I use the term informal learning to refer to happenstance and self-directed

learning that occurs in the context of collaborative work.

CHAPTER TWO: LITERATURE REVIEW

Introduction

The purpose of this study was to explore how collaborative technologies influence the informal learning experiences of virtual team members. In this chapter, I review the literature that is germane to the study's purpose. Specifically, my goal for this review was seek answers to the following questions:

- What are the inputs, processes, and events that trigger, support, and impede virtual informal workplace learning?

- What role does technology play in facilitating informal workplace learning among virtual team members?

This chapter is divided into three major literature review sections: (a) virtual team work, (b) informal workplace learning, and (c) virtual informal workplace learning, with technology's impact on each interweaved into each section. A fourth and final section provides a conceptual framework and descriptive model that synthesizes and integrates the findings of this literature review.

Multiple resources were used to ensure that the research and theory literature I reviewed was trustworthy and rigorous. My primary resource was The University of Georgia Libraries System. I used the Galileo databases to search for peer reviewed articles from reputable, academic journals. The interdisciplinary nature of this research topic required that this review include in its scope a number of disciplines including instructional technology, human resource and organizational development, educational psychology, information technology, business management, and communications;

therefore, I searched databases such as Academic Search Premier, Business Source

Premier, Communication and Mass Media Complete, ERIC, Professional Development

Collection, PsycARTICLES, Psychology and Behavioral Science Collection, and

PsycINFO. Using the following search terms, I had consistent success in locating relevant

articles: virtual teams, informal workplace learning, technology, and collaboration. I

relied on peers and professors from the aforementioned disciplines for help in locating

seminal studies not available through Galileo. I also used the GIL catalog to search for

books cited by the authors of peer-reviewed journal articles. Finally, I found search

engines such as Google and Yahoo useful in locating government-sponsored studies and

relevant statistics frequently cited in journal articles. Appendix A provides a sample of

the matrix I used to summarize and critique the studies that I found during my search.

Virtual Team Work

Since this study seeks to explore informal learning in the context of work, it is

essential that I examine the literature pertaining to what types of collaborative

technologies virtual teams use to accomplish work and how the use of those technologies

impacts their work. Once I have discussed collaborative technologies and their use in

virtual team work, I will take a closer look into how informal learning occurs in the

context of virtual team work.

Computer-Supported Cooperative Work

An examination of how collaborative technologies facilitate the work of virtual

teams must begin with a discussion of current and future research in computer-supported

cooperative work (CSCW). CSCW is a formal area of inquiry "concerned with how

technology can help people work together more effectively" whether virtual or co-located (Coovert & Thompson, 2001, p. 2). Since Irene Greif and Paul Cashman coined the phrase during a workshop in 1984, scientists, scholars, and practitioners from such diverse disciplines as anthropology, business, cognition, computer science, ergonomics, human-computer interaction, human factors, information technology, office automation, organizational design, psychology, and sociology have been drawn to CSCW (Coovert & Thompson, 2001). The challenges inherent in such a multidisciplinary field of study, as characterized by Grudin and Poltrock (1997), are the "Tower of Babel" problem and a lack of shared knowledge. Those interested in CSCW often use different terms to describe the same concept and contribute their research and lessons learned to different journals, books, and conferences. What further challenges the field is a split in research foci. While some researchers investigate the technological aspects of CSCW and others focus their investigations on the collaborative aspects, CSCW is "best conceived of as an endeavor to understand the characteristics of cooperative work behavior with the objective of designing adequate technology to support it" (Coovert & Thompson, 2001, p. 6).

The Evolution of CSCW Technologies

   Group Decision Support Systems. Technologies that support cooperative work have evolved over the last three decades and each new generation of technologies has expanded the scope of support available to individuals, groups, teams, and organizations. Research on Group Decision Support Systems (GDSS), an application designed specifically to support cooperative work, began over 20 years ago in business management schools. GDSS was originally intended as an electronic support system

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designed to facilitate decision-making among high level managers meeting face-to-face

(Grudin & Poltrock, 1997). Through a network of computers, managers used GDSS for

idea creation and to vote on alternative decisions during ad hoc meetings but not for

continuous cooperation (Andriessen, 2003). Originally very expensive, GDSS were only

used by high level mangers, but, as costs dropped, lower-level project teams began using

these decision support tools.

In the mid 1980s, GDSS researchers began attending CSCW conferences and

using the term GDSS more generally to include all technologies that facilitate decision

making including email, and some began to think that GDSS was synonymous with

CSCW (Grudin & Poltrock, 1997). Eventually the "D" in GDSS was dropped to reflect

the new emphasis on a variety of technologies, not just electronic meeting support

systems, and the new acronym became GSS (group support systems). GSS researchers

now contribute research to their own journals and focus on project and large group

support. They rarely use the term CSCW, since CSCW research tends to focus on small

groups or teams composed of 10 members or less. Despite their different foci, the GSS

and CSCW literatures now both use the term "groupware" (Grudin & Poltrock, 1997).

Groupware. Groupware is a generic term that can refer to hardware, software, and

services designed to support face-to-face or virtual group collaboration (Coovert &

Thompson, 2001). According to Dennis, Pootheri, and Natarajan (1998), groupware

enables work in a number of ways by allowing participants to:

- generate, read, and organize information in an archived, structured form

- edit, move, and structure the information in many different formats, so that the structure can add meaning to the comments and reduce the effects of information overload

- use headings and position in the structure to choose what they wish to read

- [make] anonymous comments

- vote on, or otherwise quantitatively analyze, the relative merits of alternatives; vote by ranking or rating alternatives

- [archive] group or organizational memory (p. 68)

In general, groupware products have features that support processes essential to collaborative work such as communication, information-sharing and collaboration, and coordination (Grudin & Poltrock, 1997). Table 2.1 lists groupware features that support each of these processes.

Table 2.1 Groupware Features that Facilitate Group Work Processes

Process	Synchronous Features	Asynchronous Features
Communication	Videoconferencing, voice conferencing, and text-based chat session	Electronic mail (with video, voice, text)
Information-Sharing and Collaboration	Multi-user white boards, application sharing, desktop conferencing systems, brainstorming tools, meeting facilitation systems, and multi-user virtual worlds	Information management, document management, multi-user hypertext systems, threaded discussions, and shared information spaces with retrieval features
Coordination	Videoconferencing, shared-information space with ability to switch presenters	Access control features in shared virtual spaces, library check out features in document management systems, calendar and scheduling, project management, and workflow management systems

Note. Adapted from "Computer Supported Cooperative Work," by J. Grudin & S.E. Poltrock, 1997, *Advances In Computers*, pp. 269-320.

Research findings show that, in practice, groupware has not been an overwhelming success in supporting collaborative work (Andriessen, 2003; Coovert & Thompson, 2001; Grudin & Poltrock, 1997). In their book which includes an extensive review of groupware research, Grudin & Poltrock (1997) identified technical and social/organizational challenges to groupware's success. Technical challenges included integration of media, interoperability, and insufficient flexibility. Social/organization challenges included disparity in work and benefit, critical mass, disruption of social processes, exception handling, unobtrusive accessibility, difficulty of evaluation, failure of intuition, and the adoption process. Andriessen's (2003) review identified other factors contributing to the non-use or limited-use of complex group support systems such as "complexity of the system, lack of user-friendliness, limited advantage over other media, and inadequate introduction of media and training" (p. 21).

In a book that chronicles the history of CSCW and reviews empirical studies related to the behavioral effects of computer-mediated communication, Coovert and Thompson (2001) provide a thematically organized list of the specific findings of CSCW research conducted over the last three decades. These findings are summarized in Table 2.2. While their findings primarily include studies examining text-based "computer-mediated communication systems," they are applicable to more commonplace systems and tools such as email which continues to be the most popular form of communication among teams and within organizations (Duarte & Snyder, 2001).

Table 2.2 Findings of CSCW research

Theme	Finding(s)
Participation Equalization	"Computer-mediated team members tend to participate more equally than do face-to-face members" (p. 46).
Inhibitions and Controversy	"Electronic communication media appear to reduce inhibitions and increase controversy among teammates" (p. 47).
Team Conformity	"Computer-mediated teams are less likely to reach consensus than face-to-face teams, especially when they are inexperienced. Computer-mediated teams experience little pressure to conform; face-to-face teams who are attempting to reach consensus require fewer voting rounds than do computer-mediated teams. Third advocates (defined as the third member to publicly endorse a team decision) are significantly less likely to shift their opinions toward their teammates' proposals than they are when participating via computer; computer-mediated teams are less likely than face-to-face members to submit to conformity pressures" (p. 47).
Discussion Comprehension and Recording Accuracy	"Computer-mediated teams are especially likely to encounter general coordination difficulties. Computer-mediated members have reported more difficulty understanding one another" (p. 48).
Team Performance	"It is presently unclear whether the computer-mediated communication medium affects team task performance, because empirical results regarding this important outcome variable are somewhat inconsistent (p. 49). These inconclusive findings might be the result of different research settings that have varied significantly in terms of team characteristics, tasks, and technological environment" (p. 50).
Time to Decision	"Regarding the time required to make a decision, computer-mediated teams tend to take longer than do face-to-face teams" (p. 50).
Process and Outcome Satisfaction	"Face-to-face participants working on collaborative judgment tasks tend to be more satisfied than their computer-mediated counterparts" (p. 50).

Note. Adapted from *Computer Supported Cooperative Work* by M.D. Coovert and L.F. Thompson, 2001, pp. 46-50.

Though Coovert and Thompson's (2001) review of the research literature related to computer-mediated communication is informative, its findings have limitations that must be considered. First, Coovert and Thompson only summarize the findings of the studies they reviewed and fail to critique the studies' methodology or findings. Second, it

only included studies ranging from 1986 to 1996. Since technology has changed significantly since then, it is risky to generalize the findings of Coovert and Thompson's literature review. Finally, it is difficult to ascertain the rigor of the literature review considering the authors do not specify the methodology they used to conduct the literature review and that as a book it is not subject to rigorous peer review.

Researchers have offered a number of recommendations for improving groupware systems so they better support cooperative work. Grudin and Poltrock (1997) recommended participatory design approaches, reward structures for using groupware technologies, and ethnographic or anthropological research studies that seek in-depth exploration of group and organizational behaviors. They argued the need for such studies because groupware is often designed based on workplace processes found in standard procedure manuals; however, the "masks and myths of smooth, consistent operation" represented in procedure manuals do not capture the truly chaotic and non-routine nature of workplace processes (p. 313). Groupware should be designed to reflect the reality of processes, not the mask/myth.

Coovert and Thompson (2001) criticized groupware because of its inability to support *interrelated* interactions and team processes. Team members operate interdependently while the work of individual *group* members, for whom groupware is designed, is not directly dependent on the work of his or her colleagues. Currently available technologies, they argue, are sufficient for individual or group work but not for *team* collaboration which may explain the results of research studies that indicate computer-mediated teams are dissatisfied with collaborative processes as supported by technology. Coovert and Thompson suggested the design of technologies better-suited for

the work of teams, called teamware, would allow "coworkers to develop and maintain shared goals, shared understanding, and the coordination of cognitive and physical activities" (2001, p. 39). They discussed two important characteristics of teamware:

> The first is the support of cognitive artifacts that are in use by the team—that is, those codifying procedures that make projects (and progress on projects) visible. Secondly, teamware must support member behaviors in a manner that models the natural work practices of those individuals and also cues task coordination among individuals. (p. 39)

The second characteristic supports Grudin and Poltrock's (1997) argument that groupware should reflect natural work practices as opposed to those that are prescribed by procedure manuals.

In summary, a review of the research related to the technical aspects CSCW suggests groupware facilitated the work of virtual team members but improvements are needed. Virtual team members require user-friendly, integrated technological systems that allow them to coordinate tasks and communicate socio-emotional cues. Of course, this body of research has limitations that should be considered. The most important limitation is that researchers have not conducted rigorous, peer-reviewed research about the technical aspects of collaborative technologies in the last five years. Considering the rapid rate at which technologies evolve and are created, the findings of technological research conducted five years ago are mostly likely not generalizable to today's technology. Current research is needed to investigate how collaborative technologies facilitate the work of virtual workers.

In the last five years, researchers have turned their attention from the technical aspects of CSCW to the relational aspects of virtual work. The terminology associated with technology enabling CSCW has also changed from "groupware" to "collaborative technologies." As mentioned previously, Munkvold (2003), who chronicled the history of CSCW technologies, pointed to the recent change in terminology from "groupware" to what he called "collaboration technology". He argued that "collaborative technology" better represents a wider focus to include organization-wide technologies that facilitate collaborative work. He listed the main categories of collaboration technologies and examples; all of which mirrored those considered groupware technologies except one— integrated products—described as collaboration product suites, integrated team support technologies, and e-Learning technologies.

In the next section, I review research that examines the relational aspects of virtual work mediated by collaborative technologies. Research conducted in this area identifies a number of relational prerequisites, also known as antecedents, which must be in place before CSCW can be successful.

Antecedents to Virtual Team Work

Many research studies related to virtual teams are premised by the theoretical assumption that "social interaction affects both the cognitive and socio-emotional processes that take place during learning, group forming, establishment of group structures, and group dynamics" (Kreijns et al., 2004, p. 155). In the next few pages, I spotlight some of these studies in an effort to clarify the affective and conative structures that research reveals must be in place before work and, perhaps, informal learning as well,

can occur. Those structures include team psychological safety, trust, effective

communication (as impacted by motivation and self-efficacy), and mutual knowledge.

Team Psychological Safety. Edmondson (1999) sought to test the effects of team

psychological safety on learning behavior and performance. Team psychological safety is

the belief among team members that it is safe to take interpersonal risks often required by

learning behaviors. Edmondson defined learning behaviors as seeking feedback, asking

for help, talking about errors, sharing information, and experimenting. Her model of

work-team learning proposed that team structures, such as context support and team

leader coaching, drive team beliefs of safety and efficacy. Team beliefs in turn produce

team learning behaviors which affect team performance.

To test her model, Edmondson conducted a mixed methods study of 51 work

teams in a manufacturing company. During phase one, she gathered preliminary

qualitative research for eight days, observing eight team meetings and conducting 17

interviews, to verify the theoretical constructs of her model and develop survey items for

phase two. During phase two, 427 participants from 51 teams took the survey developed

from the interviews and observations conducted during phase one. Edmondson also

interviewed 31 managers to help establish construct validity for survey variables. During

phase three, she conducted follow-up interviews and observations with 4 teams who's

mean scores for team learning behavior were high according to the survey and 3 teams

who's teams means were low. From this data, she developed case studies.

This study's relevance to collaborative technology's influence on virtual teams is

Edmondson's nod to context support as a factor in establishing team psychological safety.

One of her hypotheses was that "the extent of context support experienced by a team

should be positively associated with team psychological safety because access to resources and information is likely to reduce insecurity and defensiveness in a team" (p. 356). Her findings, however, did not overwhelmingly support this hypothesis. She found that access to resources and information contributed to, but did not "fully shape," an environment of team psychological safety (p. 377). She did, however, find that team psychological safety mediates the effects of context support on learning behavior. Generally speaking, she reported a consistent, significant, positive relationship between team psychological safety and team learning behavior as well as team learning behavior and performance (satisfying customer needs and expectations). Edmondson encouraged future research that investigates how structural and interpersonal factors interact.

Edmondson (1999) admitted limitations that must be considered. For example, she admitted that her study is a start but other research is needed to establish TPS as a construct and refine and extend its implications before drawing conclusions. I agree with her and suggest that future research look more closely at how information sharing and technology impact TPS, specifically in the context of virtual teams. I also concur with Edmondson's suggestion that an exploration of other contextual factors impacting psychological team safety and team learning behavior, such as how managers can influence and promote team learning, should be explored.

Trust. Other researchers (e.g., Hoag et al., 2003; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999) have investigated how trust is built by virtual teams via computer-mediated communication systems. In a study that surveyed 350 graduate students who completed a collaborative task in teams of four or five, Jarvenpaa et al. (1998) discovered that high-trust teams exhibited behaviors/strategies via collaborative technologies that

were proactive, task output driven, optimistic, dynamic, collectively responsible for clarifying team goals and role division, explicit about time management, and predictable and substantive in providing feedback. In 1999, Jarvenpaa and Leidner reported the findings of a qualitative analysis of the email communications of 3 high and 3 low trust teams as identified in the same study's survey results. They found initial behaviors, such as task-oriented communication supplemented by social communication, consistent responses to members, and explicitly expressed enthusiasm and commitment to project goals, were crucial in forming and maintaining trust.

Jarvenpaa and Leidner (1999) suggested future research address ways in which virtual teams learn to dynamically recognize and rectify problems which jeopardize trust in the initial phase of team building and, from an organizational perspective, how virtual teams transfer learning and knowledge from one virtual team to another. I suggest future research also be conducted in actual workplaces instead of with university students. Jarvenpaa and Leidner admitted in their limitations discussion that conducting the study with graduate students instead of employees jeopardized the study's applicability.

Effective Communication. A dominant feature of research literature devoted to relational links between virtual team members is the comparison of virtual and face-to-face teams. Many researchers appear to be fixated on whether or not virtual teams communicate as effectively and/or develop social links as effectively as face-to-face teams. Similar to the results of more than 350 studies on distance education, some researchers have found that no significant difference exists between the two groups (Hoag et al., 2003); while others have found evidence that refutes those results.

Warkentin, Sayeed, and Hightower (1997) questioned whether or not teams using a web-based discussion board called *MeetingWeb* would develop social links as strongly as would those who worked face-to-face. Relational links, as defined by the researchers, are group dynamics such as motivation and self-efficacy that determine a group member's willingness to contribute information. In their investigation of relational links, the researchers randomly assigned undergraduates to teams—11 three-member teams who collaborated face-to-face on a problem-solving task requiring communication and 13 three-member teams who collaborated on the same task online using MeetingWeb. The researchers found relational links to be a statistically significant contributor to the effectiveness of information exchange but did not find evidence to support one team's effectiveness over the other. Although the mean for the uniqueness of information items exchanged for face-to-face teams was higher than that of virtual teams, these differences were not statistically significant and thus failed to support the hypothesis that face-to-face groups exchange information more effectively.

The lack of evidence to support the superiority of face-to face communication over virtual team communication is contradictory to previous studies conducted by two out of three of the same researchers who found face-to-face teams exchange information more effectively than do virtual teams. These earlier studies by Hightower and Sayeed (1995, 1996) were very similar in methodology and task. The difference was in mode of communication. Hightower and Sayeed used a synchronous conferencing system. Regardless of what technology was used, in each study of the three studies there was only one tool available to team members. This situation is not realistic to the workplace where virtual workers have a number of tools from which to choose and will switch to another

when one is not useful to the task at hand. Future research should reflect the complexity of the workplace by considering the myriad of tools available to teams collaborating on real-world problems.

In yet another comparison of face-to-face and online team interaction, Hoag et al. (2003) employed a pretest/post-test control group design to measure the effect of the treatment—online interaction—on an experimental group of 28 students who meet and collaborated online for a semester in a telecommunications management course. The results of the pre and post tests from the control group of 37 students were compared with the experimental group's results. The researchers did not specify what the pre and post tests measured or what questions it included, but the study's results were informative. They found no significant differences and declared technology a "neutral" component with respect to enhancing learning (p. 369).

The inconclusive findings regarding the relative effectiveness of face-to-face versus virtual teams reflects similar findings in the research investigating the relative effectiveness of face-to-face classroom instruction and online learning environments (Bernard et al., 2004). Reeves (2005) questions the value of continuing to conduct such comparative studies in the online learning area, and it may be time to question the value of such studies in team communications as well. Hightower and Sayeed (1996) suggested future research be longitudinal to capture how changes in group dynamics impact information exchange among virtual team members.

Mutual Knowledge. The communications literature identifies the problem of "mutual knowledge" or the establishment of "common ground" between members of geographically dispersed teams. Citing research that found "when task-relevant

information is distributed among members of a group, there is a risk that they will fail to share and heed uniquely held relevant information," Cramton (2001) raised the question of how new collaborative technologies would affect the mutual knowledge problem (p. 349). By studying the archived email, chat, team logs, and final products of 13 six-member virtual teams engaged in a collaborative task to create a business plan, she found "both physical dispersion of collaborators and frequent use of communications technology tend to negatively affect the means by which people establish mutual knowledge" (p. 364). Failures of information exchange and interpretation impeded mutual knowledge. Technological error and selective distribution caused team members to unevenly distribute critical local information. Team members also experienced uneven feedback cycles, difficulty in interpreting the silence of fellow team members, and the tendency of team members to attend to different parts of the same information. Cramton pointed to feedback lags as an amplifying factor in failures of information exchange and interpretation. Future research, she suggested, should investigate the relationship between mutual knowledge and performance. While she found no clear relationship between the two, she recognized that the task designs in her study were not sensitive enough to detect a connection. She wrote, "…designs should vary the distribution of task-related information across locations and the amount of interdependence required of team members" (p. 366). It was unclear, however, how to do that and how it would help show a clear relationship between mutual knowledge and performance.

The mutual knowledge problem also prompted the research of Sole and Edmondson (2002) who studied how local, situated knowledge of virtual team members influences learning and working in virtual teams. They defined situated knowledge as

"knowledge embedded in the work practices of a particular organizational site" (p. 20) and team learning "in behavioral terms as the acquisition and application of knowledge that enables a team to address team tasks and issues for which solutions were not previously obvious" (p. 18). The researchers used the critical incident technique during semi-structured interviews with seven dispersed cross-functional development teams at a multi-national company and captured 44 learning episodes or occasions in which "a team learned something significant that advanced the project" (p. 20). A qualitative analysis of those learning episodes yielded several findings. Knowledge situated in local sites inhibited virtual collaboration, but when that knowledge was identified and leveraged it was a highly valuable source of team learning. In order to overcome the challenge of raising virtual team awareness of relevant situated knowledge, Sole and Edmondson recommended situated knowledge be codified in the form of stories in searchable databases so that virtual team members may become aware of the uniquely held expertise at each local site, but surprisingly they did not specifically mention knowledge management systems in either their conclusions or implications for practice and research.

While research in the relational development and effectiveness of virtual teams using computer-mediated communication has a history of inconsistent results (Maznevski & Chudoba, 2000; Walther, 1995), the combined results of these studies inform researchers and practitioners of antecedents that may affect virtual work, and perhaps, informal learning. The studies also highlight the importance of investigating and choosing collaborative technologies that support the development of interpersonal relationships and mutual knowledge. A question that remains unanswered by this body of literature is how do factors such as team psychological safety, trust, effective

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communication, and mutual knowledge affect virtual team collaboration and learning in the context of a work-related project.

Summary of Virtual Team Work Literature

As demonstrated in this section, regardless of the terminology used, technology has barriers to overcome if it is to effectively and efficiently facilitate collaboration among virtual teams. Andriessen (2003) identified five conditions that drive the effectiveness of technology as an enabler of collaboration that should be considered in future design:

- individual acceptance and choice of tools

- match between tool and task

- group and organizational characteristics

- design and implementation

- appropriation, learning, and innovation (p. 39)

Andriessen's conditions are potentially powerful because they appear to address the shortfalls of technology designed to support the collaborative work of virtual teams as identified by research. They provide feasible, but as yet untested, solutions (e.g., individual acceptance and choice of tools) to technology's inability to build virtual team relations such as trust, socio-economic cues, effective communication, and mutual knowledge and to facilitate natural work processes. The last condition alludes to a matter linked to CSCW and one that will be given considerable attention in the remainder of this review—learning.

This review of the virtual team work literature also reveals the lack of recent, rigorously peer-reviewed research. For example, most of the CSCW literature related to

the technical aspects of groupware was published in books and not in peer-reviewed journals. The research was also conducted prior to 2001, limiting the relevance of its findings about technologies that have significantly changed since then. After 2001, researchers turned their attention to the relational aspects of CSCW. One limitation of the relational research is that a number of studies were conducted at universities with students instead of the workplace. Current, rigorously peer-reviewed research about both the technical and relational aspects of virtual work is needed to impact practice and inform future research.

<div align="center">Informal Workplace Learning</div>

What is often overlooked in the virtual team literature is not only are teams collaborating while working, they're learning while working— learning as they adapt to virtual team processes and routines, learning as they construct individual and shared knowledge, and learning as they adapt to technologies designed to enable learning and collaborative processes. According to Bitter-Rijpkema, Sloep, and Jansen (2003), these types of formal and informal learning are important to high performance professionals who are also permanent learners. Today's work requires that professionals learn to creatively use available knowledge and experiences to develop innovative solutions. Traditional approaches to professional learning and development, such as training sessions and performance support, neglect to facilitate "the learning required for collaborative, creative problem solving, learning to work with new methods and tools, and organizational learning" (Bitter-Rijpkema et al., 2003, p. 19). Learning is not restricted to formal education and is best situated in authentic tasks performed during work. Work, learning, and innovation can and should be unified (Brown & Duguid,

1991). In this next section, I will discuss the theory and research focused on informal

workplace learning as a precursor to discussing how technology impacts the processes

associated with informal learning in the workplace.

Informal Workplace Learning Theory

Victoria Marsick and Karen Watkins are leaders in the area of informal workplace

learning (Cofer, 2000) and have, perhaps, the most well-known and most often cited

model. In 1990, they introduced their conceptualization of informal workplace learning

and its importance by discussing the difficulty workers experience in transferring what

they learn in training sessions to their everyday work (Marsick & Watkins, 1990). While

acknowledging the value of formal learning via classroom instruction and advocating its

link to informal learning, they expressed their view that learning is more effective when it

is situated in a real life context. They defined informal learning and what they consider its

subcategory, incidental learning, as follows:

> Informal and incidental learning both speak to learning outside formally
>
> structured, institutionally sponsored, classroom-based activities. As a result, both
>
> informal and incidental learning often take place under non-routine conditions,
>
> that is, when the procedures and responses that people normally use
>
> fail….Informal and incidental learning, however, are not exactly the same.
>
> Incidental learning is defined as a byproduct of some other activity, such as task
>
> accomplishment, interpersonal interaction, sensing the organizational culture, or
>
> trial-and-error experimentation. As such, incidental learning is never planned or
>
> intentional, whereas informal learning can be planned or intentional, as for

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example, in self-directed learning or help consciously sought from coaches or mentors. (p. 6-7)

Marsick and Watkins (1990) identified the defining characteristics of informal learning as experience-based, non-routine, and tacit. They discussed each of these characteristics in reference to the foundational theories that underlie them but gave considerably more attention to the concept of learning from experience. The authors began their discussion of experiential learning by distancing their definition of the concept from that used in formal education by theorists such as David Kolb. Instead, they defined it as "the way in which people make sense of situations they encounter in their daily lives" (p. 15). They referenced several prominent theorists such as John Dewey, Eduard Lindeman, Kurt Lewin, and Chris Argyris and Donald Schon to support their emphasis on critical reflection as a source of informal learning. In fact, they credited Argyris and Schon's action science, inspired by John Dewey and Kurt Lewin, as the primary influence on their model.

Through several case studies which tested their model at the individual, group/organization, and practice levels, Marsick and Watkins (1990) identified six iterative, non-sequential processes in informal learning: "problem framing, problem formulation, solution finding, solution testing, reframing, and reformulation of the problem" (p. 214). They further identified conditions necessary for learning from work experiences to include collaborative learning and a supportive organizational context that encourages learning. A key implication for practice is that "informal and incidental learning must take place with the collaboration and joint inquiry of others in the workplace who form a learning community. Learning from experience involves other

people...the learning of one person is inextricably intertwined with the learning of others in natural work groups" (p. 209). They also listed proactivity, creativity, and critical reflectivity as enhancers of informal workplace learning.

Marsick and Watkins' have revised their model since 1990. The first revision occurred in 1997 when they incorporated a deeper level of reflection called double-loop learning into their model. Double loop learning occurs when the learner engages in critical reflection to learn from his mistakes by correcting errors in perception, judgment, and conclusions (Marsick, Volpe, & Watkins, 1999). The second revision took place in 1998 and was inspired by the findings of Cseh (1998). Cseh's literature review found that context was a significant factor in informal learning and criticized Marsick and Watkins' earlier models by describing them as too abstract (Marsick et al., 1999). After considering Cseh's findings, Marsick and Watkins worked with Cseh to refine the model again. Their collaborative effort resulted in a model that stresses the importance of context and reflects the findings of a number of case studies related to informal learning. Figure 2.1 shows the model after these two iterations.
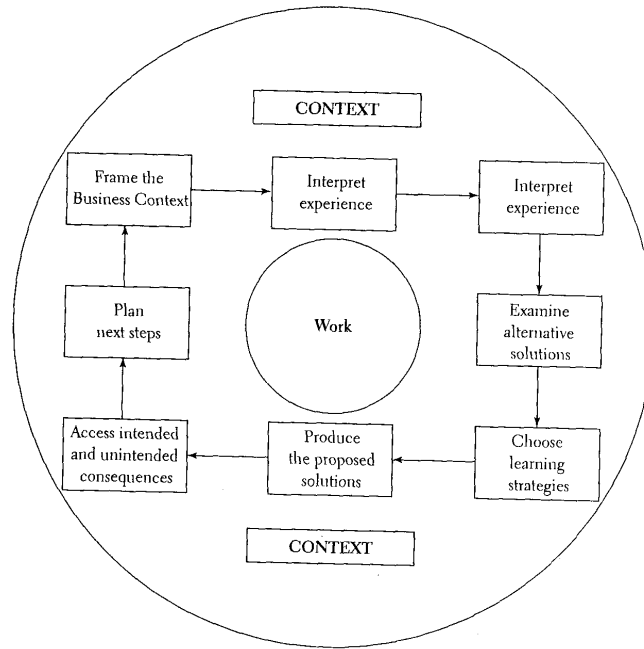
Figure 2.1 Re-conceptualized Model for Informal and Incidental Learning
From "Theory and Practice of Informal Learning in the Knowledge Era," by V.J.
Marsick, M. Volpe and K. E. Watkins, 1999, *Advances in Developing Human Resources*,
29, p. 91.

Other theories and models of informal workplace learning are found in the

literature, but none garner the popularity and longevity of Marsick and Watkins'. Table

2.3 provides a summary of each of these theories including key definitions and the

processes and events that each theorist considers essential to facilitating informal learning.

Also listed are the theories or theorists referred to as influential in the discourse of

informal learning.

Table 2.3 Informal Workplace Learning Theories

Theorists and Cited Influences	Key Definition(s)	Processes that Facilitate Learning	Events that Facilitate Learning
Collis and Margaryan (2005) Influences: Merrill	Informal learning occurs on the job in communities of practice. Informal learning and formal learning should be blended.	Integration, activation, application, and demonstration in the context of solving real-world problems	Collaboration, knowledge sharing and learning from others, supervisor support, reuse of knowledge artifacts, differentiation, and technology (key enabler)
Doornbos, Bolhuis, and Simons (2004) Influences: Marsick and Watkins, Illeris, and Wenger	Work-related learning can be deliberate or spontaneous and occurs in real-life situations that result in individual learning and shared understandings.	Learning individually, from others, and with others	Individual and group reflection, use of cultural artifacts, modeling, guiding, coaching, and mentoring.
Illeris (2003) Influences: situated learning, communities of practice, critical and transformative learning	Workplace learning is both an individual and social process with three dimensions: cognitive, emotional, and social-societal.	Workplace learning has two processes: 1) interaction between the learner and the environment, and 2) inner mental acquisition and elaboration processes.	Personal development, socialization, qualification, and competence development
Beckett and Hager (2002) Influences: John Dewey, Chris Schon, and Michael Polanyi; reflective thinking, situated learning, double-loop learning	Practice-based workplace informal learning is organic/holistic, contextual, activity- and experienced-based, collaborative, learner-activated, and arising in situations where learning is not the main goal.	Learning by making tacit knowledge explicit	Reflection is implied as an event but specific events are not explicitly specified.
Garrick (1998) Influences: Dewey, Lewin, Argyris, Schon, Kolb, Marsick and Watkins, Lave and Wenger, Polanyi, Mezirow	Informal learning occurs within day-to-day experiences. It is dynamic and "open to multiple configurations" (p. 1).	Informal learning is a holistic process shaped by power relations and discourses.	Negotiations, dilemmas, conflicts, successes, and failures

The theories and models of informal workplace learning discussed in this section attribute varying processes and events to facilitating informal learning; however they share a number of commonalities. For instance, they all emphasize the importance of learning in work-related contexts from collaboration and reflection. They also demonstrate the complexity of factors that may influence informal workplace learning and reveal its theoretical grounding in theories, such as Lewin's, which emphasize authentic, situated, practice-based experiential learning. A conceptual framework which incorporates all of these supporting theories while acknowledging the complex and varied factors affecting informal workplace learning is needed. In the next sections, I will discuss real-world examples of informal workplace learning that are unplanned and planned and then discuss whether research supports or rejects the hypotheses of what processes and events lead to informal learning that have been proposed by theorists and practitioners.

Practical Examples of Informal Workplace Learning

In some cases, informal workplace learning is spontaneous or incidental, and in others it is engendered by organizations. Examples of unplanned informal workplace learning include worker dialogue, self-directed use of the Internet, and mentoring relationships formed by employees without prompting from the organization. Dobbs (2000) presented examples of unplanned workplace learning or "simple moments of learning" as found in the research of the EDC. They included water cooler conversations and impromptu hallway meetings. While these examples tend to be incidental, unplanned informal workplace learning can also be *purposefully* driven by the worker.

The Internet, for example, is a tool for self-directed informal learning. Gray

(1999) wrote about the Internet's role in adult informal learning and speculated that it

"could possibly be classified as one of the most powerful and important self-directed

learning tools in existence" (p. 120). Informal mentoring is another source of unplanned

workplace learning, but it has evolved to become more formalized in the workplace

(Colley et al., 2002). Table 2.4 presents Hunt's juxtaposition (as cited in Colley et al.,

2002) of informal and formal mentoring styles and outcomes. His juxtaposition

demonstrates how purposefully *planned* informal workplace learning can influence and

change learning outcomes. Based upon their work in 1997, Marsick and Watkins would

argue that it is a change for the better.

Table 2.4 Unplanned and Planned Informal Workplace Mentoring

	Unplanned	**Planned**
Styles	- Individual goals - High social intensity - Voluntary friendship - Indefinite time-span - Less directive - Difficult to track, perceptions biased - Suited to smaller enterprises - Paternalistic	- Organizational goals - Medium social intensity - Relationship mediated by matching process - Limited time-span - More directive - Monitored according to specified criteria - Suited to large organizations - Organizationally structured
Outcomes	- Political awareness for privileged group - Passing on skills to juniors - Linking junior and senior managers - Reflected glory for mentor - Sponsorship of the privileged - Exclusivity of dominant grouping	- Acculturation for all new managers - Skill training for increased productivity - Fast-track developing of talented newcomers - Rejuvenating older managers at 'plateau' - Promotion according to merit - Inclusivity for diverse groupings

Note. Adapted from "Non-formal Learning," by H. Colley, P. Hodkinson & J. Malcolm, 2002, Retrieved June 11, 2005, from http://www.infed.org/archives/e-texts/colley_informal_learning.htm

Marsick and Watkins (1997) encouraged managers to inspire informal learning by "planning for learning, creating mechanisms for learning in teams, and developing an environment conducive to learning" (p. 304). They advocated planning for informal workplace learning, because "planning makes learning more conscious, better focuses effort and increases measures of accountability" (p. 305). Examples of informal workplace learning purposefully choreographed by organizations abound. Cofer (2000) provided many examples. Two are as follows:

- "During assembly line shift changes [at Motorola], shifts overlap by a half-hour or more. During the overlap, departing workers and supervisors would update the upcoming shift of any problems they had encountered. During this exchange, the employees may discuss probable causes and solutions" (p. 1).

- "By conducting an hour and a half session first thing in the morning, one organization brought together employees from two separate units to learn more about each other. Coffee and donuts were served, and each group was given one half hour to present, leaving another 30 minutes for a 'cocktail-party' style discussion and networking" (p. 2).

Cofer also suggested technologies, such as intranet websites, chat, and discussion boards, be used to enable informal information exchange between workers.

Dobbs (2000) referenced anecdotes similar to Cofer's Motorola example. He described how leaders at Reflexite created 10 minute overlaps in shifts so that workers could mingle with others in the organization. "The theory is that if workers get to know each other personally, they're more likely to take an interest in one another's work. When that happens, conversations veer toward work-related matters—and learning inevitably

takes place" (p. 53). According to Dobbs, executives at Honeywell Data Instruments had the same theory in mind as they encouraged workers organized in small groups to take frequent breaks and engage in team discussions. Their conversations often revolved around work because it's what they have in common. Finally, Dobbs mentioned mentoring or coaching as a source of planned informal workplace learning used by companies such as IBM that "matches beginners with seasoned veterans so that they can learn from casual interaction as well as explicit teaching" (p. 57).

Marsick and Watkins (1990) described how the following strategies were used to enable informal workplace learning among community educators:

- Involving learners in choices in the design and implementation of learning in order to develop proactivity

- Learning from experience through a combination of action and reflection

- Developing a collaborative resource network on which workers could draw to solve problems

- Using methods and materials oriented to reflectivity

- [Making] explicit the frequently tacit nature of learning (p. 96)

Marsick and Watkins suggested that these informal learning strategies be combined with formal, planned training programs.

Informal Workplace Learning Research

Theory and practice provide a number of prescriptions for facilitating informal workplace learning, but does research conducted in the last 15 years support those prescriptions? According to research, what precursors, processes, and events trigger and

support informal workplace learning? In this section, I will discuss these questions and the empirical studies that have sought to answer them.

Most informal workplace learning research explores what factors inhibit and/or encourage informal workplace learning. Each examines these factors and the very nature of informal workplace learning in different contexts. Most are qualitative interview studies with complementary methods of critical incident, observation, or document analysis (e.g., Ashton, 2004; Beckett & Hager, 2000; Day, 1998; Ellinger, 2005; Michael Eraut, Alderton, Cole, & Senker, 1998; Lohman, 2000, 2003; Sambrook & Stewart, 2000; Slotte, Tynjala, & Hytonen, 2004; Tikkanen, 2002; Vernon, 1999). A small number of quantitative studies (e.g., Clarke, 2004; Enos, Kehrhahn, & Bell, 2003; Skule, 2004; Thompson, Locander, & Pollio, September, 1989) and mixed methods studies (Billett, 1995; Cheetham & Chivers, 2001) involved surveys designed to gather data across professional settings so that findings were more generalizable. Two overarching critiques of the reviewed studies are their lack of specificity in the methods sections and their neglect to investigate informal workplace learning in the context of virtual teams. Regardless of the context in which the studies were conducted and the methods used, their findings consistently identify three factors which influence informal learning in the workplace: collaboration and teamwork, change, and organizational culture. Only research studies that relate to informal learning and these three factors are discussed in this chapter.

Collaboration and Teamwork. Collaboration and teamwork were identified by researchers as the most fertile ground for cultivating informal workplace learning (Billett, 2001; Cheetham & Chivers, 2001; Conlon, 2004; Day, 1998; Michael Eraut et al., 1998;

Leslie, Aring, & Brand, 1997; Sambrook & Stewart, 2000; Tikkanen, 2002; Vernon, 1999). After reviewing the findings of several case studies exploring informal learning in different contexts, Marsick and Volpe (1999) concluded the following: "…it is clear that informal learning in today's workplace is not a solitary venture…success depends on listening to one another, checking for understanding, ensuring that people are 'on the same page,' and negotiating around conflicts and differences of opinion" (p. 9).

Findings from a mixed methods study conducted by Cheetham and Chivers (2001) also confirmed the importance of collaboration and teamwork in informal workplace learning. They asked 452 practitioners from 20 professions to rate from 1 to 5 the importance of various forms of informal learning in gaining professional competence. Working alongside more experienced colleagues and working as a part of a team ranked second and third. The qualitative portion of their study, which included 80 practitioners, identified a number of benefits from learning in the context of teamwork:

- Improvement of communication skills and empathy
- Supportive and therapeutic benefits that can "…help reduce stress and provide catharsis when needed following traumatic situations" (p. 275)
- Improved team-member confidence and reduced self-consciousness when co-located with team members
- Increased appreciation of the diversity of styles and approaches

Table 2.5 lists other forms of collaboration identified by researchers as significant to informal workplace learning.

Table 2.5 Forms of Collaboration Found Significant by Researchers

Networking	• General networking (Cheetham & Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998) • Professional contacts (Skule, 2004) • Peer interaction (Conlon, 2004) • Communities of practice (Conlon, 2004)
Expert Others	• Experts designated by the organization who are accessible to employees for consultation (Billett, 1995; Michael Eraut et al., 1998)
Feedback	• Feedback from group members and/or supervisors (Conlon, 2004; Michael Eraut et al., 1998; Skule, 2004)
Mentoring	• General mentoring (Conlon, 2004; Michael Eraut et al., 1998; McDowall-Long, 2004; Sambrook & Stewart, 2000)
Coaching	• General coaching (Conlon, 2004; Michael Eraut et al., 1998; Sambrook & Stewart, 2000) • Teaching others (Cheetham & Chivers, 2001)
Reflection	• Reflecting on action (Beckett & Hager, 2002; Conlon, 2004; Enos et al., 2003)

Change. A number of researchers also identified change as a trigger for informal

workplace learning. Skule's (2004) mixed methods study of 1500 public and private

employees in Norway revealed a number of learning conditions that promote informal

learning. Employees attributed a high degree of exposure to changes in technology and

working methods as one condition triggering informal learning. Another identified

condition, which could be construed as related to change, was a high degree of exposure

to demands from customers, colleagues, or the organization. Similarly, Tikkanen's (2002)

qualitative study of eight bank and engineering employees in Finland found changes in

technology and work processes as external stimuli to informal workplace learning.

Furthermore, public school teachers in Lohman's (2003) qualitative study cited changes

in work situations, particularly new teaching tasks and new leadership roles, as triggers to

participation in informal learning in the workplace. These changes initiated new skills

and competence acquisition achieved through interaction with peers and self-directed learning.

Organizational Culture. Researchers who have investigated the context within which informal learning occurs overwhelmingly discovered that organizational culture directly impacted the ability of employees to successfully engage in informal learning. Researchers have found that organizational cultures conducive to informal learning possess the following characteristics:

- The organization's leaders and managers are committed to and support learning (Ellinger, 2005; Michael Eraut et al., 1998; Leslie et al., 1997; Sambrook & Stewart, 2000; Skule, 2004).

- Work tools and resources, such as computers, the Internet, software, telephones, and manuals, are accessible to employees (Ellinger, 2005).

- Rewards are in place that motivate proficiency and learning (Ashton, 2004; Lohman, 2000; Skule, 2004).

- Time and space are set aside for informal workplace learning (Ellinger, 2005; Lohman, 2000; Marsick et al., 1999; Sambrook & Stewart, 2000).

- Trust exists and motivates employees to admit their mistakes and learning needs to colleagues and superiors without fear of reprisal (Ashton, 2004; Cheetham & Chivers, 2001; Day, 1998; Marsick & Volpe, 1999; Sambrook & Stewart, 2000; Tikkanen, 2002).

Research that examines the impact of organizational support in the context of virtual work and learning is needed given the proliferation of virtual teams.

Summary of Informal Workplace Learning Literature

Research regarding informal workplace learning substantiates some of the triggers, processes, and events that theorists and practitioners have hypothesized are necessary to facilitate informal learning. For example, research confirmed the significance of various events associated with collaboration and reflection such as teamwork, networking, feedback, mentoring, coaching, and expert others. It also drew attention to change as a trigger to informal learning and to organizational culture as able to support or impede informal learning.

Research also supports the findings of virtual team work studies cited in the previous section which identified trust as an antecedent to work and learning. A question that still remains is: what are the findings of research that specifically examine informal learning in the context of a virtual team that relies on technology to facilitate its work. Though I found no such study in my review of the literature, several studies provide very helpful insight into how virtual team members learn from one another. I discuss those studies in the next section.

Virtual Informal Workplace Learning

In this section, I discuss how collaborative technologies can informally facilitate the integration of work and learning of individuals who work virtually. While very few empirical studies exist that attempt to specifically address this issue, a number of concepts inform future research on the topic: virtual business learning (VBL), knowledge sharing and management, e-mentoring, integrated intelligent support systems, and computer supported collaborative learning (CSCL).

VBL. Researchers at the Open University of the Netherlands developed the VBL concept and grounded it in "social constructivism, competence based learning, communities of practice, the learning organization, authentic situated learning, learning by doing, distance learning, and knowledge productivity" (Bitter-Rijpkema et al., 2003, p. 19). The premise of VBL and its technological environment is "the modern professional's needs can only be met by flexible learning arrangements embedded in the professional's work practice, or at least in authentic, work-like settings" (p. 19). A VBL environment seeks to increase the competencies of its employees and the team and organization. Its essential environmental components include:

- an authentic or real business setting

- complex, non-routine, ill-structured tasks (duties, responsibilities)

- explicit facilitating of active construction of knowledge, new ideas, working methods

- assessments derived from professional practice and its performance standards

- a supporting ICT infrastructure (p. 20)

Bitter-Rijpkema et al. (2003) provided two anecdotal case studies of successful VBL implementations. One consisted of teams of graduate students using an intranet web environment to store organizational and learning information. An e-room and groupware platform facilitated their collaborative work. The other example consisted of information technology (IT) managers adding features to their existing Lotus Learning Space platform to transform it into a VBL environment. The goals of this VBL environment were to introduce "new trainees to IT basics and the working methods of the company" (p. 22). Successes of both applications, as it relates to team learning, included:

- Improved facilitation of integrated learning processes on multiple dimensions

- Development of domain knowledge skills, combined with social, communicative, and organizational skills required for teamwork

- An explicit and critical reflection on the learning processes and a transfer of valuable experiences to organizational memory (p.23)

Researchers should conduct studies which seek to verify the successes of these anecdotes and investigate if or how the embedded nature of the VBL environment in the everyday work of virtual teams sparks informal learning experiences. VBL has the potential to become one of the ways in which knowledge can be shared and managed informally. Now, I will turn to research that specifically examines the impact of knowledge sharing and management.

Knowledge Sharing and Management. Knowledge sharing and management are significant sources of informal workplace learning (Ashton, 2004; Ellinger, 2005). Though a complete discussion of the benefits of knowledge sharing and management is beyond the scope of this chapter, I will discuss two studies to demonstrate how knowledge sharing and management through the use of collaborative technologies can facilitate virtual, informal learning.

Herrmann, Kienle, and Reiband (2003) wrote, "…the task of knowledge management is to support individual learning and the exchange amongst the employees as well" (p. 9). In their qualitative study of five German companies, they employed semi-structured interviews, observations, and document analysis to discern success factors and barriers to the introduction and use of knowledge management systems (KMS) such as

Livelink, Lotus Notes, and an in-house designed KMS. The results of the study indicated that KMS should function to make users aware of:

- Quality and timeliness of content

- Information about other users such as organizational units, competencies, and work areas

- Knowledge of what will happen to their uploaded knowledge

- Processes for maintaining or updating content generated by the team or individual

- Relevance or usage of the content they enter

- How content should be structured and what knowledge should be included

Results of the study also indicated that KMS functionalities that influence change include access rights, discussion forums, enhanced search features, and annotated content. One unfortunate criticism of the study is that its methods and procedures are not detailed enough to determine the applicability of the results to other contexts.

In a qualitative case study, Thomas, Sussman, and Henderson (2001) explored how the Center for Army Lessons Learned (CALL) institutionalized strategic learning processes at multiple levels within the U.S. Army. The researchers conducted 32 semi-structured interviews with staff and organizational leaders and used the content analysis method to derive their findings. They also examined artifacts and used member checks to verify their findings. They found that CALL successfully used technologies such as bulletin boards, databases, and multimedia training to help members of their organization contribute, collaborate, and disseminate tacit and explicit knowledge more rapidly. The researchers critiqued their findings by acknowledging that CALL has a unique

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knowledge management system and encouraged others to consider this limitation when reading their results.

These studies demonstrate the benefits of knowledge management and sharing and how informal learning among virtual teams can be captured and shared, making tacit knowledge explicit and accessible to team members. Well-designed KMSs can be an important source for establishing mutual knowledge among virtual team members.

Integrated Intelligent Support Systems. Contributing an integrated perspective of knowledge sharing and management that can lead to virtual, informal learning, Baets (1998) contended that the pooled knowledge of individuals within an organization can lead to effective policy decisions. He proposed a framework for an integrated intelligent support system consisting of four components: case-based reasoning, group decision support, cognitive mapping, and artificial neural networks. Only those beneficial to virtual informal learning are discussed here:

- Case-Based Reasoning System (CBRS)—supports learning through case studies. Indexed cases allow organizations to retrieve similar cases from a case-library. Organizations can use these similar cases to solve current problems.

- Group Decision Support System (GDDS)—supports learning through participatory strategy formation (LPSF). LPSF has become a common, contemporary phenomenon in organizations. Capabilities of each GDSS varies but essentially "they reduce communication barriers by providing technical features such as the display of ideas, voting compilation, anonymous input/interaction, decision modeling, electronic mail and the bulletin board function" (p. 185).

- Cognitive Mapping System (CMS)—supports learning through sharing individual knowledge. In a CMS, individuals compose cognitive maps representing their mental models of knowledge around an issue or subject matter. The CMS then pools the individual maps to represent the group, team, or organizations knowledge around an issue or subject matter.

Such a support system could produce significant improvements in the work and learning of virtual team members and break down team relational barriers discussed earlier in this chapter such as lack of trust, mutual knowledge, and effective communication.

Virtual Mentoring. Virtual mentoring, also referred to as e-mentoring, can be a source of informal or formally coordinated virtual, informal learning. Bierema and Merriam (2002) asserted that as the world shifts to a more global orientation, technology can facilitate the shift by facilitating mentoring relationships across social, economic, cultural, or physical boundaries. They defined a mentor as a wise person or guide who assists in a protégé's growth and development. A mentor's duties include teaching, counseling and supporting their mentee, and modeling attitudes and behaviors.

Bierema and Merriam (2002) defined e-mentoring and discussed the results of related research. They defined e-mentoring as "…a computer mediated, mutually beneficial relationship between a mentor and a protégé which provides learning, advising, encouraging, promoting, and modeling, that is often boundaryless, egalitarian, and qualitatively different than traditional face-to-face mentoring" (p. 214). Existing research about the success or potential success of e-mentoring is limited. They called for more work in "identifying those aspects of the electronic medium that limit as well as foster a genuine mentoring relationship" (p. 215). Bierema and Merriam also examined the

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various contexts in which e-mentoring has been applied. One context they described was mentoring centers and corporate sponsored programs helping to link members of organizations to communities of practice. They theorized the following benefits of e-mentoring:

- Relationships can exist that cross boundaries of time, geography, and culture

- Formal and informal online exchanges when face-to-face communication is impractical

- Low barriers to entry

- Time efficient and convenient

- Large amounts of information exchanged in a short time span

An additional benefit theorized by Bierema and Hill (2005) is that virtual mentoring "holds the potential to build, capture, and share knowledge in a knowledge society" (p. 565). They also describe some of the corresponding challenges to virtual mentoring including cost and access to technology, online communication skills, privacy, training, match between mentor and mentee, and sustaining the relationship.

After reviewing nearly 20 years of research on mentoring, McDowall-Long (2004) found that marked differences between formal and informal mentoring exist, but researchers have not investigated those differences as much as general mentoring outcomes. One difference that McDowall-Long noted was that formal mentoring programs are shorter in duration and "consequently, the degree of mutual disclosure, authenticity and empowerment in formal relationships may be markedly reduced from that inspired by informal relationships" (p. 529). Additional research into informal virtual

mentoring is needed to inform ways in which it can be supported among virtual team members.

Computer Supported Collaborative Learning. Although many of its researchers (e.g., Kirschner & Van Bruggen, 2004; Kreijns et al., 2002; Kreijns et al., 2004) view computer supported collaborative learning (CSCL) through a formal education and training lens, the principles of CSCL can be applied to learning that occurs informally within the context of virtual teamwork. For example, Borges and Baranauskas (2003) extended CSCLs applicability to workplace learning settings and drew parallels between CSCL and CSCW:

> We can think of Computer Supported Collaborative Learning (CSCL) based on some concepts of Computer Supported Collaborative Work (CSCW), as both combine communications and computer technologies to support various activities involving groups in collaborative problem solving situations. The process of knowledge construction is promoted by activities involving internal negotiation and deliberate actions such as goal setting, negotiation, identification and discussion of problems and their solutions. In this kind of environment adult workers can experience a constructivist aesthetic approach to learning, motivated by their own professional work context. (p. 64)

Kirschner and Van Bruggen (2004) present a four-process cognitive framework that specifies the conditions necessary for the construction of new team knowledge. The four processes that usher the team from unshared knowledge to knowledge construction are externalization (unshared knowledge), internalization (mutual understanding also known as common ground), negotiation, and integration. A sense of community where

trust, shared understanding, a common goal, and accountability are present is essential to the process.

A technological system that supports Kirschner and Van Bruggen's cognitive framework would be helpful. In a qualitative investigation of how thirty employees learned informally to work more effectively in teams, Vernon (1999) employed the critical incident technique and interviews to identify the following critical components of an effective communication system in the workplace:

- Creates and affirms spontaneous peer interactions involving information sharing, support for pressing issues, and technical assistance on interpersonal matters or skills

- Encourages and welcomes dialogue between team leaders and members that results in a willingness to risk engaging in innovative learning projects, shared assistance in achieving individual and group goals, and support for growth and productivity

- Facilitates individual inquiry, understanding of effective learning styles, and acquisition of needed resources

- Provides reinforcement and affirmation of colleagues and managers as facilitators of learning (p. 40)

Future research should seek to identify technological systems that possess the characteristics identified by Vernon and support Kirschner and Van Bruggen's cognitive framework and investigate how those systems influence virtual work and learning.

Summary of Virtual Informal Workplace Learning Literature

In summary, research, albeit somewhat limited, has shown that collaborative technologies facilitate virtual, informal learning by affording opportunities for authentic, situated workplace learning in a number of ways. VBL, knowledge sharing and management, virtual mentoring, integrated intelligent support systems, and CSCL are the constructs of researchers and practitioners who have attempted to make explicit the tacit processes and outcomes of learning while working. While these constructs are helpful, future research should seek to explore informal learning specifically within project-based virtual team contexts, since work is what drives informal workplace learning and since virtual work is becoming more prevalent.

An Integrated View and Conceptual Framework

My purpose in reviewing the literature related to virtual team work, informal workplace learning, and virtual informal workplace learning was to answer two questions:

- What are the inputs, processes, and events that trigger, support, and impede virtual informal workplace learning?
- What role does technology play in facilitating informal workplace learning among virtual team members?

Answers to these questions as informed by this literature review are presented in a conceptual model that I have created as Figure 2.2 called the Virtual Informal Learning System (VILS). The model presents a systems view of the concepts which frame virtual informal learning in the context of work as encased by the organizational and larger global environment. Each component of the model and its relationship to the other

components is discussed in this section. The model begins with what were identified as

antecedents or inputs to virtual team work and consequently virtual informal learning, so

my description of it will begin there as well.
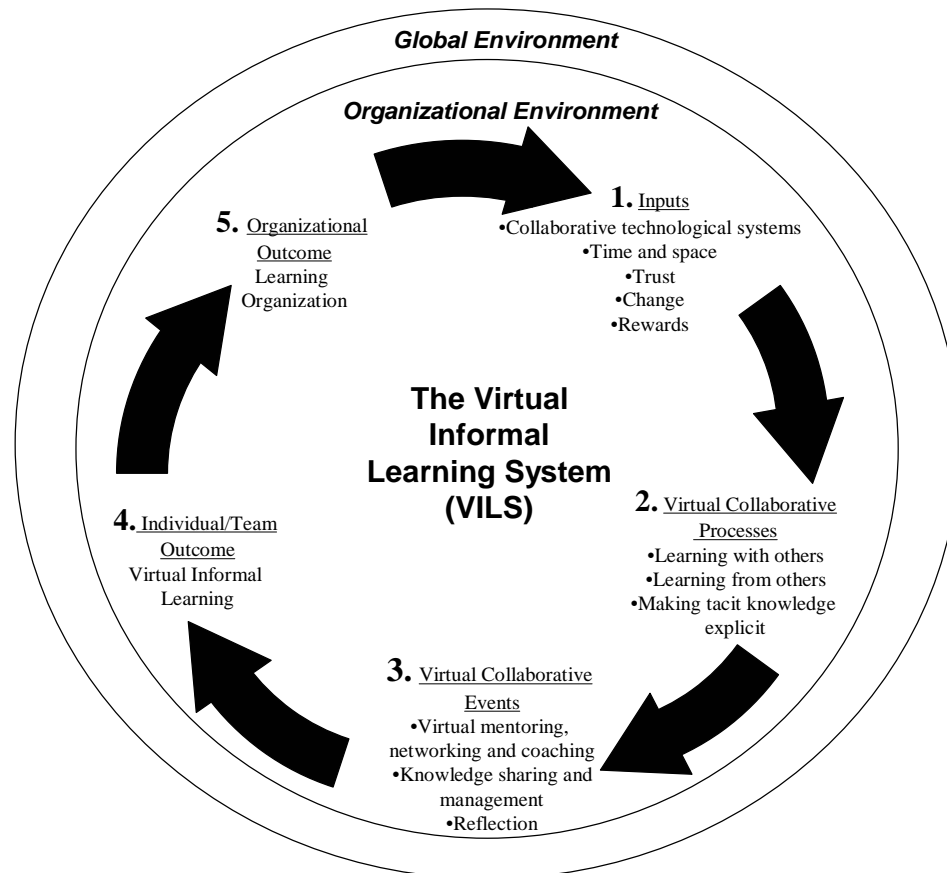
Figure 2.2 The Virtual Informal Learning System (VILS)

Inputs to VIL

Inputs identified in this literature review as essential to establishing the structure

that makes opportunities for virtual, informal workplace learning possible include

collaborative technological systems which facilitate effective communication (Hightower

& Sayeed, 1995, 1996), mutual knowledge (Coovert & Thompson, 2001; Cramton, 2001;

Edmondson, 1999; Sole & Edmondson, 2002), and trust (Ashton, 2004; Cheetham &

Chivers, 2001; Day, 1998; Hoag et al., 2003; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999; Marsick & Volpe, 1999; Sambrook & Stewart, 2000; Tikkanen, 2002); time and space for learning (Ellinger, 2005; Lohman, 2000; Marsick et al., 1999; Sambrook & Stewart, 2000); change (Lohman, 2003; Skule, 2004; Tikkanen, 2002); and rewards for using collaborative technologies (Grudin & Poltrock, 1997) and for learning (Ashton, 2004; Lohman, 2000; Skule, 2004). These inputs encourage and support collaboration, the act most likely to spark informal learning process and events.

Collaborative VIL Processes

Collaborative processes that have been suggested by research as resulting in virtual informal learning include learning from others (Billett, 1995; Cheetham & Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998; McDowall-Long, 2004; Sambrook & Stewart, 2000), learning with others (Billett, 2001; Cheetham & Chivers, 2001; Conlon, 2004; Day, 1998; Michael Eraut et al., 1998; Leslie et al., 1997; Sambrook & Stewart, 2000; Tikkanen, 2002; Vernon, 1999), and making tacit knowledge explicit so that it can be managed and shared with others (Ashton, 2004; Ellinger, 2005; Herrmann et al., 2003; Thomas et al., 2001). These collaborative processes occur in conjunction with collaborative events.

Collaborative VIL Events

Collaborative events supported by research as having a significant influence on virtual informal learning include teamwork (Billett, 2001; Cheetham & Chivers, 2001; Conlon, 2004; Day, 1998; Michael Eraut et al., 1998; Leslie et al., 1997; Sambrook & Stewart, 2000; Tikkanen, 2002; Vernon, 1999), mentoring (Billett, 1995; Cheetham &

Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998; McDowall-Long, 2004; Sambrook & Stewart, 2000), coaching (Cheetham & Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998; Sambrook & Stewart, 2000), networking (Cheetham & Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998; Skule, 2004), consulting with experts (Billett, 1995; Michael Eraut et al., 1998), feedback (Conlon, 2004; Michael Eraut et al., 1998; Skule, 2004), knowledge sharing and management (Ashton, 2004; Ellinger, 2005; Herrmann et al., 2003; Thomas et al., 2001), and reflection (Beckett & Hager, 2002; Conlon, 2004; Enos et al., 2003). These collaborative events lead to virtual informal learning.

VIL among Individuals and Teams

The hypothesized outcomes of virtual informal learning are two-fold: (1) improved individual and team performance and (2) a learning organization. These outcomes are hypothesized because only one study found in the literature claimed its findings suggested a significant positive relationship between informal workplace learning and performance (Day, 1998). Since informal workplace learning is primarily collaborative, it follows that learning at the individual level is also experienced among team members and, with knowledge management and sharing mechanisms in place, that learning rolls up to the organizational level.

The Learning Organization

Interestingly, the organizational characteristics specified by research as integral to creating a work-environment conducive to informal workplace learning are those espoused by scholars such as Senge (1990) and Kline and Saunders (1998) who advocate

the creation of what have been called *learning organizations*. Garavan (1997) has suggested that there are three issues that should be considered in identifying or creating a learning organization:

- Learning cultures—the culture of organization must be supportive

- Structures/socio-structures—structures must facilitate progression towards the learning organization ideal

- Psychological maturity and learning—individuals must be receptive to greater accountability and responsibility in the organization

The first two of these three issues are considered inputs in the VILS model, so the hypothesized circularity of the system is logical even though it is unproven. The inputs, processes, and events of virtual, informal learning lead to a climate that creates a learning organization, while a well-functioning learning organization produces the inputs that generate more virtual, informal learning.

Conclusion and Research Implications

As this review has demonstrated, informal workplace learning is a complex phenomenon composed of inputs, processes, and events. Its theoretical origins stretch back to the work of John Dewey and modern-day theorists continue to attempt to describe its nature and identify the mechanisms that support and impede it. Technology is one input that is especially influential when informal learning must occur among team members who work virtually via collaborative technologies. Though little empirical evidence exists that explores informal workplace learning in the context of virtual teamwork and collaboration, other research, such as that examined in this review, is helpful in forming a guiding conceptual framework. The VILS model described in this

review may be helpful to future researchers to the extent that it might aid them in

conceptualizing the vast amount of information provided by multiple disciplines related

to the topic of informal workplace learning.

CHAPTER THREE: METHODOLOGY

Introduction

In this chapter, I describe the qualitative methodology that I used to explore how collaborative technologies enhance or inhibit the informal learning of virtual team members. Specifically, this chapter details the research design, data collection and data analysis procedures that guided me in gathering data to address the following research questions:

1. How do virtual team members describe their informal workplace learning experiences as facilitated by technology?

    a. What are the perceptions of collaborative technologies among virtual team members?

    b. How do collaborative technologies facilitate or inhibit informal learning among virtual team members?

2. What cognitive, social, emotional, motivational, and contextual variables affect the informal learning of virtual team members? How do collaborative technologies impact those variables?

    a. How do team psychological safety, trust, and mutual knowledge relate to informal learning in the context of virtual work? What role do collaborative technologies play in supporting those relationships?

    b. How does the organization support virtual team member learning that is informal and enabled by collaborative technologies?

I begin by describing and justifying the research tradition and methodological strategy that constitute this inquiry's research design. I then outline the procedures I used to collect and analyze research data. Finally, I discuss issues of validity, reliability, ethics, and my role as researcher.

<p style="text-align:center">Research Design</p>

The Interpretive (Qualitative) Research Tradition

Denzin and Lincoln (2000) offered a definition of qualitative research that characterizes its purpose and methods:

> Qualitative research is a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or to interpret, phenomena in terms of the meanings people bring to them. (p. 3)

In other words, the interpretive, qualitative tradition seeks to understand the meaning people construct from their experiences while interacting in their social worlds (Merriam, 1998). Keeping in mind that the theories that undergird informal workplace learning are based on the epistemological belief that people learn and make meaning during their interactions with others (Marsick & Watkins, 1990), the qualitative research tradition was theoretically aligned with and most appropriate for the design of this study.

<p style="text-align:center">63</p>

Qualitative researchers employ different strategies to understand how individuals make meaning. They choose their strategies by first considering their research questions and then choosing the strategies that best suit their investigation. Qualitative scholars define and categorize the strategies of qualitative research in different ways (e.g., Denzin & Lincoln, 2000; Merriam, 1998; Patton, 2002). For this study, I used the generic strategy of qualitative inquiry as characterized by Merriam (1998).

The Generic Strategy of Qualitative Inquiry

Basic or generic qualitative studies are those that possess what Merriam (1998) listed as the essential characteristics of qualitative research—"…the goal of eliciting understanding and meaning, the researcher as primary instrument of data collection and analysis, the use of fieldwork, an inductive orientation to analysis, and findings that are richly descriptive" (p. 11). Merriam deemed the generic study the most common form of qualitative educational research and distinguished it from other types of qualitative research by defining it by what it is not. Basic or generic qualitative studies, she wrote, "…do not focus on culture or build a grounded theory; nor are they intensive case studies of a single unit or bounded system…[they] simply seek to discover and understand a phenomenon, a process, or the perspectives and worldviews of the people involved" (p. 11). Other characteristics of the generic study include its theoretical draw from many disciplines, data collection methods such as interviews, and data analysis methods of thematic or categorical identification.

The generic strategy was most appropriate for addressing this study's purpose and research questions for two reasons. First, my goal was to discover and understand the phenomenon of informal learning as enabled by collaborative technologies. My purpose

was not to build theory, nor did I study a single unit or bounded system. Second, as is characteristic of generic qualitative research, I will draw on theories from multiple disciplines, such as Instructional Technology, Human Resource and Organization Development, and Educational Psychology, to conduct this study. These reasons led me to select the generic qualitative methodology for this study.

Methods

Interviews are a frequently used qualitative data collection method (Bogdan & Biklen, 2003; Creswell, 2003; Merriam, 1998, 2002; Patton, 2002). I chose interviews as the primary method for gathering data concerning my research questions and used the critical incident technique (CIT) to prepare participants for interviews. Merriam (1998) advised, "Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them. It is also necessary to interview when we are interested in past events that are impossible to replicate" (p. 72). Since it would have been impractical and intrusive to observe virtual workers as they engaged in informal learning, I chose to rely on interviews, during which participants could reflect on past incidents of informal learning. I also used the CIT to help participants reflect on past experiences. The CIT is a qualitative research method designed to "…capture the complexity of job behavior in terms of the job's social context" by collecting stories, episodes, or incidents about job behaviors crucial to successful job performance (Stitt-Gohdes, Lambrecht, & Redmann, 2000, p. 59).

The Critical Incident Technique. Colonel John C. Flanagan created the critical incident technique during World War II, and since then it has been used in many governmental, business, and educational research projects (Fivars & Fitzpatrick, n.d.).

Flanagan (1954) defined the technique as "…a procedure for gathering certain important facts concerning behavior in defined situations" (p. 335). Flanagan also emphasized that it is a flexible technique absent of rigid rules for data collection. In using the technique, the researcher prompts the participant to write about a specific incident, describing the details of the incident and explaining how the actions of the participant and others led to an effective or ineffective outcome (Fivars & Fitzpatrick, n.d.). Qualitative research is about capturing stories that generate helpful data (Patton, 2002). During interviews, I intended to ask participants to recall incidents of informal learning, so the CIT was a valuable tool in preparing them to retell those incidents.

Interviews. I used the interview guide approach as characterized by Patton (2002) to gather data from participants after they had critically reflected on incidents of informal learning. As prescribed by this approach, I outlined the sequence and wording of interview questions in advance. Preparing an interview guide in advance provides the following advantages (Patton, 2002):

- The outline increases the comprehensiveness of the data and makes data collection somewhat systematic for each respondent.
- Logical gaps in data can be anticipated and closed.
- Interviews remain fairly conversational and situational. (p. 349)

Although I prepared the interview guide in advance, I recognized that it might evolve after each interview, so I remained flexible with its content and the order of the questions. I designed the interview protocol to elicit a 60-90 minute interview session.

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Data Collection Procedures

Table 3.1 summarizes the data collection procedures that led this study. The remainder of this section details each of procedure.

Table 3.1 Data Collection Procedures

January	1. Recruited participants
February	2. Asked participants to use reflection guide to reflect on critical incidents of informal learning 3. Conducted 12 semi-structured, audio-taped telephone interviews over three weeks
March	4. Transcribed and summarized interviews 5. Had participants "member check" summaries

Participant Selection

In order to understand the informal learning experiences of virtual team members, I selected a sample that would provide the richest opportunities for meeting the study's purpose and addressing the study's research question. As is characteristic of qualitative research and most appropriate for this study, I used purposeful sampling to select research participants (Creswell, 2003). In addition, I followed LeCompte, Preissle, and Tesch's (1993) suggestion to develop a list of criteria to lead me in my search for participants. Creating and following criteria resulted in the "…identification of information-rich cases" (Merriam, 1998, p. 62).

Based on the purpose of this study, I established the following criteria for selecting participants:

1. The participant should be currently engaged in one or more virtual team projects. The participant's team members should not be located in the same building and have limited "in-person" contact with one another. Ideally, the participant's team

members will be located in other states within the United States or in other countries. This criterion increases the probability that the participant engages in virtual work via collaborative technologies and meets criterion number two.

2. The participant must use two or more collaborative technologies to accomplish virtual work and interact informally with fellow team members. Examples include virtual meeting systems, email, audio/video conferencing, interactive weblogs, wikis, and intranet sites.

3. The participant must be willing to critically reflect on their informal learning experiences and participate in one 60-90 minute interview.

After establishing these criteria, I began searching for participants that would fit them. First, I composed and sent an email to friends, family, professors, and other doctoral students outlining the purpose of this study and the criteria for research participants. I asked them to forward me the names and email addresses of people they knew who met the criteria and to notify these potential participants that I would be contacting them regarding the study. This first step resulted in my receiving the names and email addresses of 17 potential participants.

Second, I sent those 17 potential participants an email indicating that they had been nominated to participate in my study. I briefly described the purpose of the study and the tasks they would be asked to complete over the course of the study. I also specified the participant criteria. I then asked them to complete the following steps if they met the participant criteria and agreed to participate in the study: respond to the invitation email with a list of dates/times for participating in a 60-90 minute interview, read the

attached consent form, sign both copies, and return one copy to my home address before the scheduled interview time. A copy of the consent form is found in Appendix B.

Finally, each time I received an email agreeing to participation and listing potential interview dates/times, I responded by confirming the interview date/time and negotiating how the interview would take place. Considering interview participants were located in various cities across the United States and those within driving distance of the researcher indicated their preference for a telephone interview, I conducted all of the interviews by phone using a pre-paid calling card, so participants would not incur any long distance charges. When confirming the interview date/time, I also forwarded them a reflection guide, as shown in Appendix C. I asked that they review the definitions of informal learning and collaborative technologies and think through instances of informal learning before the interview. I scheduled each interview approximately 5-7 days after the participant received the reflection guide to ensure that they had ample time to engage in reflection.

In designing this study, I had hoped to successfully recruit a minimum of 10-15 participants. As Patton (2002) advised, I estimated 10-15 participants as the minimum sample size "based on expected reasonable coverage of the phenomenon given the purpose of the study and stakeholder interest" (p. 246). Of course, the number of participants could have fluctuated depending on when data redundancy occurred (Merriam, 1998). In all, 12 participants participated in the study. Table 3.2 includes descriptive data for each study participant. Pseudonyms are used in the table and throughout this document.

Table 3.2 Participant Descriptive Data

Pseudonym	Current Position	Highest Degree/Major	Years Virtual
Charles	High School Administrator	Graduate degree in Computer Science	6
Michelle	Software Implementer	Business and Information Systems	2
Rebecca	Public Relations Director	BA in Political Science; MA in Interdisciplinary Studies	4
Andrew	Executive Services Director	Computer Science and Mathematics; Advanced work in Business	10
Kijana	Editor	Graduate work in Literature	9
David	Systems Architect and Software Developer	BA in Computer Science	5
Michael	Executive	Applied Physics	15
Victoria	Managing Consultant	Advanced work in Technology with a minor in Business	6
Eric	Senior Technical Recruiter	BA in Psychology	8
Gigi	Editor and Project Manager	MA in History; MA in Library Science	5
John	Executive	PhD in Instructional Technology	7
Rita	Attorney and Case Manager	Law degree	3

Study participants represent a diverse group of professions. All work from home offices, except Eric, Rita, and Charles. Eric and Rita work from their organization's headquarters but accomplish work goals daily with globally dispersed team members and/or clients. Charles works from an administrative office, but his team members are distributed across his state.

Interviews

I conducted 12 interviews over the course of three weeks ranging from 30-90 minutes. I spoke with participants via speaker phone in a private, locked office, and audio-taped each interview. During each interview, I took field notes which helped me generate probing questions not included in the original interview protocol. At the end of each of the first three interviews, I revised the interview protocol and guide for better

flow and clearer questions. Revisions were not necessary after the third interview. I became comfortable with the content and order of the questions and the guide was eliciting a depth of response that I found sufficient. The final interview protocol and guide appear in Appendix D.

After conducting each interview, I wrote a brief summary analysis for each interview based on field notes and replaying each audiotape. It included a participant description and a bulleted list of the main ideas of each interview. I emailed this summary analysis to participants with the invitation to make any changes using "track changes" in Microsoft Word if they found any inconsistencies or wanted to add any comments. I also advised them that if did not receive a reply within one week, I would assume the analysis was accurate. Only three participants returned the document with changes made. The participant descriptions from these analyses are included in the Findings chapter of this dissertation. A summary of the main points made during each participant's interview are found in Appendix E.

<div align="center">Data Analysis</div>

In analyzing interview data, I followed Ruona's (2005) step by step method for preparing, coding, and cross-analysis using Microsoft Word. As outlined in stage one of her method, I began preparing interviews for data analysis. I transcribed four interviews and commissioned a professional transcriptionist to transcribe the remaining eight. Next, I converted the text of the first interview into a table format with six columns: code number, participant identification number, question number, turn number, data, and notes.

According to stage two, I began analyzing participant responses for my first interview. As I read through the data, I identified meaningful segments. Segments

included phrases, sentences, paragraphs, or entire passages. My strategy during this segmenting process was to chunk the data so that it could be later coded while taking care not to lose the context of the chunk. Without context, the segment would become meaningless. I created a new row in the table for each segment and filled in the participant identification number, question number, and turn number columns. On occasion, I captured notes in the notes column. In those cases, I usually hypothesized connections between segments of data or made notes about possible ways to code the segment. I then repeated stages one and two for two more interviews, converting those transcripts to tables then segmenting the data into meaningful chunks.

As prescribed in stage three, I reread each of the three interviews prepared in stages one and two and began compiling a preliminary list of codes. Next, I combined similar codes and then sorted those codes into categories. I then assigned a five digit code to each category and the codes within the category. With that initial coding system, I coded three interviews, assigning each segmented chunk a code number in the code column. While doing so, I refined my coding scheme as new themes emerged and as I realized that some codes should be combined, moved to other categories, or refined. For example, I initially created a code called *Virtual Work*, but as I segmented and chunked each interview I realized that there were many facets to virtual work, so I made *Virtual Work* a category with a number of corresponding codes. Those codes included *motivation for working virtually*, *perception of virtual work*, *advice to other virtual workers*, *work experience as a factor for success*, and *relationships with virtual team members*. I then performed stages one, two, and three on the remaining nine interviews, continuously revising my coding scheme. This stage produced twelve tables containing interview data

that was labeled, chunked, and coded. A page from one participant's interview transcript that was segmented and coded in stages one through three appears in Appendix F.

In the final stage of data analysis, I merged all twelve tables into a master table and began the process of cross analysis. I sorted the data by code using Microsoft Word's sorting feature. This allowed me to combine and group data according to code from all twelve interviews. As I read through data from each code, I began detecting themes among participants. In some cases, I further segmented and recoded the data as I found it was more appropriate for other categories. In other cases, I realized the strength of a theme, created an additional category for it with supporting codes, and resegmented and recoded the data accordingly. For example, in the earlier stages of coding, I grouped *relationships with virtual team members* under the category of *Virtual Work*, but after combining data across interviews I realized its strength as its own category by the frequency and richness of associated participant comments. I then adjusted my coding scheme by making it a new category with codes such as *the importance of relationships* and *building trust*, and recoded and further segmented the data accordingly. After making these changes, I re-sorted the data by code. Appendix G features the final coding scheme, and Appendix H features a sample of the master table that aided me in the cross-analysis process. Throughout this process, I was constantly interpreting and generating meaning as I recognized and made connections between emerging themes. Those interpretations and connections were often chronicled in the notes column of the master table.

Validity and Reliability

Issues of internal and external validity should be considered when proposing a study. Internal validity addresses the question of whether or not the results of a study

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reflect reality (Merriam, 2002). Strategies that I used to enhance the internal validity of this study are as follows (Creswell, 2003):

- Member checks. I asked each participant to review a summary analysis of their interview which included a description of them and a bulleted list of the themes generated from their interviews. I wanted confirmation that I captured what was said or what they meant to say.

- Peer examination. A post-doctoral student and a doctoral student served as peer examiners. I often discussed data collection methods and preliminary findings with them to reflect on the process and receive feedback about my interpretations.

- Clarification of researcher theoretical orientation, experience, and bias. I address these factors in this dissertation in the final section of this chapter.

External validity is concerned with whether or not the study is generalizable. I have described study participants and the context in which they work virtually in order to enhance the external validity of this study. According to Merriam (2002), the researcher should provide, "…enough description to contextualize the study such that readers will be able to determine the extent to which their situation matches the research context, and hence, whether findings can be transferred" (p. 31). A description of the expertise and experiences of interview participants has been provided in the findings chapter of this dissertation, so that readers may frame the findings of the study and decide if they apply to their team or organization.

Reliability is traditionally thought of as the results of a study being the same if conducted independently by another researcher using the same methods. Reliability in the social sciences differs. Merriam (2002) explained, "…reliability lies in others' concurring

that given the data collected, the results make sense—they are consistent and dependable" (p. 27). Strategies that I used to ensure this study's reliability include leaving an audit trail and peer examination. The audit trail documented the research journey so that the study could be replicated, and my dissertation committee examined the congruency of the findings with the data collected.

Ethical Considerations

When the researcher engages in research with participants, their lives are impacted and ethical issues emerge. Patton (2002) suggested that researchers consider a number of ethical issues. Table 3.3 lists each of these issues and how I addressed them in the context of this study.

Table 3.3 Ethical Issues

Issue	How Addressed
Explaining the purpose of the study	I informed participants about the purpose of the study in writing before data collection began.
Promises and reciprocity	Incentives were not presented in this study, so keeping promises about rewards or acts of reciprocity was not an issue.
Risk assessment	There were no known psychological or legal risks related to this study. If there were, I would have clearly stated them in the consent letter.
Confidentiality	Individuals are very hesitant to allow tape-recording during interviews. Assuring participants that data would be kept confidential through the use of pseudonyms and that their rights were protected by the University of Georgia's (UGA's) Internal Review Board (IRB) was essential to gaining their trust. I store study artifacts in my locked home-office and will destroy them five years after the study's completion.
Informed consent	The consent letter, given to study participants during the recruitment phase of the study, informed them about the study's purpose, the ethical issues listed here, and notified them of their right to cease participation at any time.

Data access and ownership	Data access and ownership belongs solely to the researcher, but I offered the participants access to a written report of the study. Participants also reviewed a summary analysis of their interviews, as this study employed "member checks" as a method of validation.
Interviewer mental health	My participation in this study increased my knowledge of the research process and of informal workplace learning. I collaborated with peer reviewers and members of my doctoral committee to critically reflect on each of those topics.
Advice	During the study, my doctoral committee and peer reviewers stood as my confidants and counselors on matters of ethics.
Data collection boundaries	I did not urge participants to answer questions that made them uncomfortable.
Ethical versus legal	I will maintain confidentiality about what I heard during interviews except in situations when I am mandated by law to do otherwise.

Researcher's Role and Theoretical Orientation

My role as the researcher obligates me to divulge my worldview or theoretical orientation because it permeates all aspects of this study, including: the research questions, the data I will consciously or subconsciously choose to include, and what parts of the data I will deem worthy of greater examination and analysis (Merriam, 1998). I situate myself theoretically in social constructivism and system theory. Social constructivism assumes that reality and knowledge are constructed through human interaction and that learning is a contextual, negotiated social process (Driscoll, 1994). Theorists who have subscribed to this orientation include Lave (situated learning theory), Vygotsky (social development theory), and Bandura (social learning theory).

System theory, another theory to which I am drawn, contends that a system is composed of parts "…so interconnected and interdependent that any simple cause-effect analysis distorts more than it illuminates. Changes in one part lead to changes among all

parts and the system itself" (Patton, 2002, p. 120). System theory is rising in popularity among qualitative researchers because it is a useful way of conceptualizing complex, real-world contexts which are embedded in larger wholes (Patton, 2002). Karl Ludwig von Bertalanffy is credited as the father of general system theory, and his ideas have grounded the work of renowned theorists such as William Ross Ashby (cybernetics), David Ruelle (chaos theory), and John H. Holland (complex adaptive systems) (Ruona, 2001).

The combination of these theoretical orientations motivated me to conduct this study to increase my knowledge of phenomena associated with them. For example, investigating informal workplace learning allowed me to explore learning that is situated in the workplace. Recruiting virtual team members as participants allowed me to investigate the collaborative construction of knowledge as mediated by technology. Examining how technology and other contextual factors, such as trust and organizational support, impact informal learning permitted me to gauge the importance of the systems surrounding individual virtual team members. My theoretical assumptions and biases led me to believe that technology would not inhibit informal learning among virtual team members.

Conclusion

In this chapter, I described the methodological design for this study. The design is a generic qualitative study. The methods that I used were critical incidents and interview. After having virtual workers reflect on instances of informal learning as facilitated by collaborative technologies during work, I conducted twelve 30-90 minute tape-recorded interviews with a diverse group of virtual workers. As appropriate for the generic

qualitative study, I used coding and thematic cross-analysis to analyze data sources. Microsoft Word facilitated the coding and sorting process. Finally, to increase the study's validity and reliability, I used member checks, peer examination, rich descriptions, audit trails, and stated my theoretical orientation and biases. In the next chapter, I discuss the findings of this study.

CHAPTER FOUR: FINDINGS

Introduction

The purpose of this study was to explore how collaborative technologies influence the informal learning experiences of virtual team members. In this chapter, I report the findings of this exploratory study as they emerged from a cross-analysis of twelve 30-90 minute, semi-structured interviews with a diverse group of virtual team members. In the first section of the chapter, I present portraits of the twelve study participants. In the remaining sections of the chapter, I present the findings of the cross-analysis framed by the study's research questions:

1. How do virtual team members describe their informal workplace learning experiences as facilitated by technology?

    a. What are the perceptions of collaborative technologies among virtual team members?

    b. How do collaborative technologies facilitate or inhibit informal learning among virtual team members?

2. What cognitive, social, emotional, motivational, and contextual variables affect the informal learning of virtual team members? How do collaborative technologies impact those variables?

    a. How do team psychological safety, trust, and mutual knowledge relate to informal learning in the context of virtual work? What role do collaborative technologies play in supporting those relationships?

b. How does the organization support or inhibit virtual team member

learning that is informal and enabled by collaborative technologies?

Participant Portraits

In this section, I present brief portraits of the twelve study participants. As shown, the participants have diverse work and educational backgrounds. What they have in common is that they work collaboratively from a distance with team members to accomplish organizational goals. In the portraits, I have used pseudonyms for all participants. All participants approved their portraits to ensure their anonymity was protected. Descriptive data for each study participant appears in Table 3.2. Summaries of each participant's interview appear in Appendix E.

Charles

Charles is an administrator at a virtual high school. He holds an advanced degree in Computer Science and previously worked as the Chief Information Officer for another high school in the same district. He works from an office, but his team members are distributed across the state in which he works. He has worked in this manner for the last six years.

Michelle

Michelle is a software implementer and customizer for a multibillion dollar company. She works from her home which is located three hours from her company's headquarters. She's been working virtually for two years and decided to move away from the city in which her company's headquarters is located for family reasons. Her company allowed her to work from home but asked that she move from the development team to

the implementation/customization team, because its projects are smaller in duration and easier to do remotely. Michelle was a Business major with a concentration in Computer Information Systems.

Rebecca

Rebecca is a Public Relations Director for a chapter of a national organization. The organization is located several states away from Rebecca who has worked from her home for four years as a contract worker for the organization. Rebecca has a BA in political science and a master's degree in Interdisciplinary Studies and Social Science.

Andrew

Andrew is the Executive Services Director for the government division of multibillion dollar computer hardware, software, and services corporation who works from home. He has over ten years of experience as a virtual worker and manages other virtual workers in his current position. He holds degrees in Computer Science and Mathematics and has completed advanced work in Business Management.

Kijana

Kijana has been the virtual editor of a national educational publication for about ten years. She recruits and collaborates with contributing authors and edits the publication with co-editors on an entirely virtual basis. This process is accomplished primarily through passing Word documents back-and-forth with "track changes" enabled until manuscripts are polished and ready for publication, but Kijana also uses a discussion board and listserv to brainstorm, discuss, and archive ideas related to the publication's mission, future direction and current issues that arise.

David

David is a Systems Architect and Software Developer for a technology company. David has been working virtually for about five years. Prior to working virtually, he spent six to nine months onsite so that his employer could become comfortable enough to allow him to work virtually from his home. David works virtually from home not only with his team members but also with end users. He has a bachelor's degree in Computer Science.

Michael

Michael is an executive at an information technology (IT) company. He has approximately 15 years of experience working virtually. He works with globally dispersed team members and clients on a daily basis from his home office. He holds a degree in Applied Physics.

Victoria

Victoria is a managing consultant in the learning and development division of a major IT company. She has been with the company for approximately 24 years and began working virtually from her home six years ago. She has advanced work in technology with a minor in Business Management.

Eric

Eric is a senior technical recruiter at a major IT company. Although Eric works from his company's headquarters, his work requires him to collaborate with other nationally dispersed recruiters. Eric has engaged in virtual collaboration with other recruiters for approximately eight years. He holds a BA in Psychology.

Gigi

Gigi has worked on a number of virtual teams in the past five years. She is currently involved in two virtual projects which she works on at home and in an office setting: editing an annual, education-related publication and implementing an international student exchange. Gigi holds a master's degree in History and another in Library and Information Science.

John

John is an executive at a national education organization. Although he works from his organization's office, he manages a number of geographically dispersed virtual teams composed of instructional design consultants and subject matter experts who develop e-learning products and services for the organization. He heavily relies on technology to make possible and facilitate the development process. He has worked virtually for approximately seven years and holds a PhD in Instructional Technology.

Rita

Rita is an attorney who works as a case manager for a large law firm. Although Rita works at her firm's headquarters, her work requires her to collaborate virtually with globally dispersed clientele, co-counsel, and third party vendors who scan, produce, and archive case-related documents. She has worked virtually for approximately three years.

Collaborative Technologies at Work

In this section, I discuss this study's findings as they relate to the following research question: What are the perceptions of collaborative technologies among virtual team members? The reported technologies included email, instant messaging, audio and

video tools, online collaborative tools, knowledge repositories, desktop sharing, and collaborative systems which integrate these tools. In addition to participants' use and perception of these technologies, I share their opinions about how they should be improved. How these technologies facilitate or inhibit informal learning is presented in the next section of this chapter titled Virtual Informal Learning Mediated by Collaborative Learning Technologies.

Email as a Source of Misconception and Reflection

All participants cited email as a frequently used form of technology, but not all considered it the most useful. Email, while mediating communication and document exchange, was a source of frustration for some. The sheer number of emails received on a daily basis from fellow team members and clients was cause for contention. Michelle shared:

> What I've now learned over the last eighteen months, having been in this group that long, is that people in this group get about sixty to eighty emails a day. It is nearly impossible [emphasized] to keep up with it and you're spinning in every direction, you know, this customer, this customer.

Eric concurred, "People get hundreds of emails a day." John explained further, "When you're very busy and you get two hundred emails a day…So email is not a valuable tool to me anymore. It is a distracter, because people expect…immediate feedback."

The asynchronous nature of email was cited by participants as both a negative and positive characteristic. Time lags between email responses, as alluded to in John's comment, can be a source of misconceptions among team members. Rebecca told of a

time when she sent an email and the anxiety she experienced when it wasn't returned when expected:

> I've been wondering and wondering why I didn't get a return and wondering if it was because of this or that or something I did or the way I said it or the fact that she doesn't want to have to do it or something like that…when in actuality that person was traveling or they never got my email or somehow it got sent to their junk file or something like that.

Other participants commented positively about the asynchronicity of email. Kijana recounted an instance when she received an email from a co-worker filled with "frustration" and "concerns." Instead of replying immediately, she waited three days to "get rid of my own emotional response." Email allowed her the "luxury of taking time to think about what would be the most useful, helpful way of dealing with this person, so this person felt heard but also could hear what I was saying." She said, "If I had gotten that information face-to-face it would've been much harder for me to pause and think about how I would have responded and probably not as successfully." Eric reported using email with virtual team members when reflection on ideas or issues was required. Michael and Gigi said email was useful because recipients could read and respond to messages on their own time.

The inability to effectively communicate tone through email can also be the cause of misconceptions among team members. Rebecca revealed, "I think emails can get really tricky too…There were questions sort of tone. You can't convey a tone in an email, so sometimes things get kind of construed." Eric elaborated, "Some people are more direct and the tone of the email is misconstrued and sometimes that can create some negative

feelings." Communicating humor through email is one of Andrew's email "don'ts," because it translates poorly, especially if an established personal relationship does not exist. He said:

> Rule number one: humor is never in email. Emails are one of the most abused electronic areas in the industry…Humor is based on the relationship…When it comes down to email, email is a business tool and it should be viewed as that.

Instant Messaging for Quick Exchanges

Instant messaging (IM), also referred to as chat, is the second most frequently used technology among participants. Charles confirmed, "Internet messaging actually probably gets utilized more than the telephone to be honest. That is something that is going on all the time." In general, participants expressed positive perceptions of IM. Charles offered a theory about this form of communication:

> Let's say that you are doing things just through IM. There's generally a conscious understanding of the limitations of that form of communication, so you kind of recognize it as being very different than typical face-to-face communication. And so there's kind of a natural adjusting and kind of moving into the culture and nature of that communication.

Charles' theory may explain why participants reported only using it for short, quick exchanges. Kijana explained:

> What I've learned is that in terms of short, short, very efficient, very clear kinds of information that instant message is fabulous. I guess what I would say is when the trust level is high and you really want to just quickly convey short bits of information, IM works really well.

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David also remarked about the convenience IM provides, "It keeps the conversation short. You can send a one or two sentence question. You get your answer back then the conversation is over." Eric commented on its efficiency, "It's a lot more efficient to get that movement versus sending an email and waiting for someone to check their box." Similarly, Gigi reported IM as a great tool when you're very busy and need a quick answer to a question.

Drawbacks to IM were that people may interrupt you while you're working and expect you to respond immediately. In some cases, the synchronicity that IM affords is a distraction and may encourage micromanaging. David discussed marking himself as "away" when he needs to work uninterrupted. When team members don't "get the hint," he logs off the IM tool.

Value in the Spoken Word

Participants reported using the telephone for one-on-one conversations when necessary but not as frequently as email and IM. David discussed using it when "it's something I absolutely need answered;" otherwise he prefers IM, because he is not "obligated" to make the call worthwhile by making informal conversation prior to asking for what he needs. Kijana commented that the telephone was useful in helping her understand the enthusiasm an author had for the topic she was writing about, but also admitted to not using the telephone frequently because it doesn't afford time for reflection. Michael asserted his lack of enthusiasm for the telephone in explaining his preference for using a whiteboard to illustrate meaning.

Participants use teleconferencing, also referred to as audioconferencing or conference calling, when multi-person audio communication or collaboration is necessary. Michael stressed the importance of staying focused during conference calls:

The problem is when you have ten people and one is distracted after while starts dragging down everybody because people start feeling like somebody isn't present and the level of attention from them starts dropping down so every so often they start doing something else.

John mentioned using a conference call, as opposed to an email, to find out what went wrong on a project. He implied that complexity of the purpose of the meeting required the type of interaction not possible in an email.

Seeing is Believing

Participants reported occasionally using video tools, such as videoconferencing, webcasting, and webcams. Video has benefits and challenges. One reported benefit is the ability to see virtual team mates and clients. Rebecca said, "The image of somebody I think is kind of helpful. I mean it is kind of nice to know what somebody looks like." Andrew found video useful in conveying body language during a webcast where instant messaging was used for question and answer: "When I received the message, they could see me reading the question, but they could see the body language of me answering it. Once again, it's a layer of sincerity to the individual who may never have met." Eric commented that higher levels of attention and professionalism occur when employees are seen, and Gigi stated that her team members expressed their appreciation for videoconferencing, especially during the planning phase of their project. Videoconferencing forced her virtual team members to focus solely on the issues before

them and not be distracted as they might be using other collaborative technologies. Rita also credited videoconferencing with facilitating the collaborative work of attorneys and clients at her law firm.

Video tools also pose challenges, because they can be expensive, technically unreliable, and difficult to schedule. Rebecca and David admitted a reluctance to use video tools regularly. Rebecca said, "I'm not just sitting in an office somewhere looking professional." David predicted, "If I ever did use it, I would only turn it on during meetings. I don't know if I would necessarily turn it on for a phone call or a formal kind of meeting that we were having."

Interactive Exchanges

Web-based collaborative tools mentioned by participants included discussion boards, blogs, and wikis. A few participants spoke of using discussion boards for posting personal information about virtual team members and for conducting work-related discussions. Charles described his organization's use of discussion boards, "People posting birthdays, facts about them, you know, things like that to help people to get to know each other better." Kijana uses discussion boards to "archive things like the theme, the big ideas that emerge from the magazine that we're going to use. We want to archive introductions of new members to the group." In David's organization virtual team members contribute to discussions about resolving technical issues and conduct design discussions online. He said:

> Let's say somebody says, 'I entered this value. I expected this result but I got this.' We can have a big discussion thread. We also use that for design discussions when we're working through the initial phases of the requirements.

Kijana expressed interest in using blogs and wikis to collaboratively edit documents and exchange ideas. Michael, on the other hand, objected to the use of blogs, He asserted, "People are going to this blog thing on the internet. Man, people are just spending their life on the internet and writing crap on that."

Knowledge Sharing

Participants discussed their use of knowledge repositories, loosely defined as places where work-related documents or media are stored. Repositories are housed on their organization's shared drive/intranet and on the internet and are, in some cases, password protected and/or searchable. Michelle, for example, reported that documents are housed and shared on her company's network and that they also use a tool called *Source Space*. She described its function as follows:

> It's kind of like a repository that stores and archives our source codes which is kind of how we generate the things that we give to our customers. It stores our source code. It can store our other types of files, so we use that…It's internal and external.

Rebecca's organization posts academic and journalistic articles to their website so that chapters within her organization and the public can access them. The purpose of this repository is to educate the public so that individuals can become advocates for themselves. Victoria also reported that knowledge repositories at her company contain media, such as video replays of meetings. When she has to miss an important meeting, she often watches the replay.

Desktop Sharing as a Visual Aid

Desktop sharing was viewed as a helpful collaborative tool among participants who reported using it. David uses it to troubleshoot problems with software applications or demonstrate a prototype with other virtual team members. He commented, "We will use that when we are talking about some more complicated concepts, things where visual aids will help the conversation." John said, "You can surf together simultaneously with all the people that are in your space. Though not termed desktop sharing, attorneys at Rita's law firm use a similar application called Live Note for real-time court reporting. She said:

> You can actually see the text as the court reporter types in the text using Live
> Note. So I can be here in [this city] and the trial can be occurring in [another city]
> and I can, on my computer through the internet, be able to tap in to the
> stenographer's typing of the text in court.

Integrating Collaborative Tools

Integrated collaborative systems are those that offer a suite of collaborative technologies that may include any combination of email, IM, video, audio, web-based collaborative tools, knowledge repositories, desktop sharing, shared whiteboards, project management tools, and multiple team "spaces" for those involved in multiple virtual team projects. Examples of integrated systems cited by participants were *NetMeeting*, *WebEx*, *Groove*, *Notes Buddy*, *Illuminate*, *Tapped In*, and *Microsoft Share Point*.

NetMeeting was most commonly used among participants. It's audio and desktop sharing capabilities fuel virtual meetings. Eric, similar to others, uses it in more formal circumstances when "I would want to have documents available so people could visibly

see what I was doing and what I was working on as well as hear *my* voice." Michael

reported using *NetMeeting* under similar circumstances, "If we are talking about the

document and we want to make sure that everybody sees the same page at the same

moment, *NetMeeting* is much better." He added that a synchronous tool like *NetMeeting*

can only be used by team members located within certain time zones: "When we work

with Japan, Taiwan, India, and you get into a twelve hour difference, it's difficult to pick

a time when everybody's available, so this type of conference is more popular over here."

Recommendations for Improvements to Collaborative Technologies

Responses to the question "If you could design a technological system for your

organization to help virtual teams collaborate, what would it be like?" inspired different

answers. Participants requested that video capabilities be added to their repertoire of tools.

For example, Eric suggested, "Maybe something involving some webcams where you

can see someone physically and see their facial expressions and gestures. It might make it

a little more personal." Other responses included requests for integrated "dashboard"

systems with emoticons, cross-platform tools compatible with both PCs and MACs, more

technically reliable tools, the ability to "drop by" as one does in the office, and

improvements to email that alert senders when or if their message has been received.

Summary

Overall, participants perceived collaborative technologies as helpful to facilitating

their work but mentioned a number of challenges inherent in each. For example,

asynchronous technologies afford the ability to respond at one's leisure, but this

affordance may generate misconceptions when time lags occur. Synchronous

technologies such as online meeting tools with video enhance meetings by affording the communication of visual cues but pose the challenge of coordinating the schedules virtual team members or clients dispersed across global time zones. They also revealed that certain technologies were more appropriate for certain tasks. For instance, IM is appropriate for short, quick information exchanges while videoconferencing is very useful in facilitating more complex tasks such as decision making. Next I describe the virtual informal learning experiences of virtual team members as mediated by these both challenging and helpful collaborative technologies.

<center>Virtual Informal Learning Mediated by Collaborative Technologies</center>

In this section, I discuss instances of virtual informal learning facilitated by collaborative technologies in an attempt to answer the following research question: How do collaborative technologies facilitate or inhibit informal learning among virtual team members? Some of the instances discussed in this section were specifically classified by participants as instances of informal learning, while others are those which I identified as instances of informal learning while analyzing their interviews. Instances are grouped by the following themes: mentoring, coaching, networking, knowledge sharing, knowledge management, making mistakes, problem solving, document creation/editing, and planning.

Before beginning the discussion, it is noteworthy to mention the participants' perceptions of informal learning. Participants expressed uncertainty as to the nature of informal learning, despite the fact that they were provided with a definition in the reflection guide. For example, Michelle's comment conveys her uncertainty:

I was not sure I came up with things that you were looking for. When you say learn something, I probably learn a hundred things a day. I ask a specific question such as, 'How do you want to perform this calculation?' Is that the kind of learning that you're talking about?

Eric spoke of the difficulty in recalling instances of informal learning, "I think that's the hardest part of this. I had to really think about this, but I do it all the time." This uncertainty is what led me to analyze not only the participants' *self-reported* instances of informal learning but also instances of informal learning I recognized as they spoke of their virtual work using collaborative technologies. For example, David spoke of forty-five minute coffee breaks that occurred when he was on site. He saw them as a source of distraction and did not consider them to be sources of informal learning. Upon probing, he revealed that those coffee breaks were a source of knowledge sharing as his co-workers discussed their projects. He said that he was able to exchange that sort of information when he worked virtually but admitted that "it's much more readily available when you're up there." Even though he had not mentioned this as an instance when technology inhibited the sharing of local knowledge, I was able to recognize and code it as such.

Mentoring

Rebecca, David, and Eric reported learning informally while participating in informal/formal mentoring relationships with virtual team members. Rebecca informally mentors chapters within her organization: "I follow their chapters in the news, so I search the news daily…I'm able to give them advice, materials, resources, and feedback." Her organization's website has a chapter's only website where documents and helpful links

are shared. David recalled mentoring another software developer: "We used a lot of *NetMeeting*, he and I, because we wanted to share some code programming language, actually write the scripts that make computer programs work." David and his mentee also used IM and the telephone to facilitate their collaboration. Finally, Eric reported having long-lasting informal and formal mentoring relationships driven by technologies such as IM, the telephone, and email. Eric's manager requested he seek advice from a virtual team member. Eric recounted:

> I was tasked with supporting a new business unit and in doing so I had to learn various parts of the business unit: how they operate, the expectations, types of individuals that they're looking for, what their expectations of me were going to be moving forward. I had to learn all of this from someone in a virtual environment.

Eric maintains another informal mentoring relationship from which he gets "advice and help and knowledge on various topics."

Coaching

Rebecca, Andrew, and Kijana relayed instances of virtual coaching. Rebecca reported learning informally as she receives coaching from a more experienced colleague:

> And then all the writing that I do—op eds and letters to the editor and big reports….My supervisor and I do a lot of that back and forth collaboration where I'm learning all kinds of things. I mean I learn so much from her. She's older than I am. She's been in the movement a lot longer, so I learn about you know moments in the history of this movement. I learn about insider stuff of what's

going on now. You know—politics. I learn about writing and what sounds good

and what doesn't sound good, and I'm learning all kinds of things from that

collaborative experience with her. So those are pretty big examples and there are

countless others.

Rebecca mentioned using technologies such as IM, email, and the telephone to mediate

their coaching relationship. Andrew recounted an instance where he coached a team

member about after the team member sent an inappropriate email. He commented on the

technology that mediated that coaching incident: "Critical point: hitting reply is not the

answer. Picking up the phone and calling direct is the answer."

Michael and John conveyed their skepticism that coaching could be effective

from a distance. Michael asserted, "Coaching through virtually is—sometimes I'm sure it

can work, but in our field it's pretty hard. You need to see." John, who tried orienting

new consultants to virtual e-learning projects both virtually and face-to-face, learned that

coaching them virtually was "unproductive and I needed to bring the person in for a day

and pay for a travel trip and productivity went way up." During face-to-face orientations,

John "clarified the project, allowed them to ask questions, to dialog about the vision, the

timeline, the deliverables, and the expertise needed by the consultant, kind of making

sure it's a match." He reiterated, "Physical proximity matters at the beginning. You got to

do it. Then you can distribute and manage effectively." After orientations, John's

producers coach subject matter experts virtually through the design process. Virtual team

members use *Groove*, an integrated collaborative system, to communicate, share

documents, and track their progress.

Networking

David, Gigi, and Eric discussed virtual networking as a source of informal learning. David said that networking through virtual technologies, such as IM, could be a source of informal learning about work-related issues, but admitted that networking is "much more readily available" when he's in the office with other team members. Gigi described an instance when her attempts to recruit authors for her annual publication via email failed, so she chose to engage in face-to-face networking at a conference. Her face-to-face networking resulted in her learning about provocative issues in education and making contacts with potential authors. Eric recounted instances of informal learning during face-to-face networking with team mates after work. He did not contribute any virtual instances, but expressed hope for virtual networking as he commented, "The dependency to have that face-to-face contact…is starting to shrink a little bit as people are becoming more comfortable with technology to obtain knowledge in various subjects."

Knowledge Sharing

Most participants' responses to questions about informal learning mediated by technology centered on episodes of sharing knowledge and information. Some of these episodes were planned while others were incidental. Michelle told of three such instances. They involved using *WebEx* to share team members' desktops for software demonstrations during virtual meetings, using IM to quickly ask a colleague how to answer a client's question, and using the telephone to gather customer requirements. Andrew reported using webcasts to disseminate the organization's strategic plans and answer related questions using IM. Victoria and Michael shared similar stories involving

presentations by organizational leaders that were delivered virtually. Some were recorded then made available for replay. Similarly, David said technology was used to conduct technology debriefings to consultants about new IT products: "How do we educate out in the field without bringing them in every time? What you do is have a technology briefing saying here's the new release and you bring them up to date." Finally, Kijana, Eric, and Gigi reported more informal instances of knowledge sharing among virtual team mates using technologies such as email, IM, telephone, and a multi-user virtual environment (MUVE) called *Tapped In*. Eric summed up the nature of informal knowledge exchanges: "If it's just knowledge sharing, something, you know, kind of quick and easy, that can be done via email, telephone, a combination of the two, instant message, something along those lines."

Knowledge Management

Participants discussed how capturing, storing, and managing their knowledge can be a source of informal, self-regulated learning. Participants confirmed their access to knowledge repositories, but only Rebecca, Kijana, and David mentioned contributing to them. Rebecca discussed creating and contributing to a web-based clearinghouse of information and e-book on various topics as well as a Chapters Only section of her organization's website where she posts "talking points on particular issues." She explained, "If someone is asked to do an interview on a subject they can go there and look at the language that I've already kind of thought through and use that kind of language, those kinds of points." Kijana and David reported contributing to and having access to discussion boards which archive ideas and issue resolution discussions. Michael

and Eric have access to shared drives or team spaces with stored documents, forms, and/or archived meeting replays.

When I asked Michelle whether she had ever contributed to lesson learned documents for posting to knowledge repositories, she said:

No. That would be really nice in a perfect world, and we do do that on some of the bigger projects, but we don't formally do that on a lot of the projects. We have such short and high speed projects that there is just not really a lot of time for that…Usually when something goes poorly is when you are more apt to do that.

No other participants reported engaging in reflection and writing sharable lessons learned documents except Rita who indicated her firm would like to create a series of best practices documents.

Only Rita, Victoria, and Eric reported learning informally from *using* stored knowledge. Rita said she and attorneys at her firm use searchable databases to find, sort, and download case-related documents but did not connect these actions with informal learning. Victoria, however, admitted learning from stored meeting replays, "When you listen to the replay, you can learn from the questions and answers from others." When asked if workers use stored knowledge, Eric responded:

Yeah. I know some of us had to use them. I mean if there was a rollout of a new process or some new technique of doing something, it would be on our shared drive, and, in most cases, we would have to use that updated procedure or document or what have you.

On the contrary, Gigi expressed doubt that members of one of her virtual teams actually accessed stored documents, and Michael mentioned his ability to access taped monthly

calendar updates but asserted his reluctance to do so: "There are too many things around. The rate of information is expanding exponentially."

Making Mistakes

Although Kijana, Gigi, and John spoke about the importance of admitting mistakes while working with virtual team members, they did not relate it to informal learning. Kijana remarked:

I think in a team, a virtual team like this, it's really important that people get a tremendous amount of sense that they have a lot of ability to decide things, that they can use their creativity, that they can make mistakes, that they can design things their way.

Gigi also talked about the value of mistakes, "I think one of the best things that can happen is for the team to have a failure or an apparent failure, come together, and pull their collective [selves] out of the ditch. Then you suddenly have investment." John talked about the need to put egos aside when giving and receiving criticisms: "You got to put egos aside and work toward negotiation and ultimately consensus."

Problem Solving

Some participants spoke of instances of informal learning related to problem solving. Charles spoke about an instance when technology facilitated problem solving and one when it inhibited it. In the positive instance, Charles reported learning informally while using desktop sharing to debunk a problem in the administrative system of his organization's learning management system:

Essentially you get to observe how someone is using a computer tool in a way

that I don't think you ever get to do in a physical environment because…personal

space or whatever…but in this way you are seeing it just like it was your screen

except someone else is doing it.

Michelle and Andrew recounted similar positive instances of troubleshooting and solving

client problems using technology. Michelle used desktop sharing while Andrew used

teleconferencing. John reported using tools like the phone, video conferencing, along

with *Groove*, when more complex decision making/problem solving is necessary.

Charles was the only participant who spoke negatively of trying to solve a

problem using technology, specifically IM. He said:

Realizing the delay that happens because you know you're waiting for one person

to type, sometimes you get overlapping, so your response back and forth has a

kind of a different pattern than like we have right now in a phone

conversation…The resolution of the problem was actually getting much worse.

Document Creation and Editing

Most participants mentioned how collaboratively creating, editing, and passing

documents among team members was a common practice. Kijana, Gigi, and John

described instances of using he "tracked changes" and "comments" features in Word and

circulated the document by email. Rita and the attorneys at her firm use a third party

vendor to scan, store, and make editable case-related documents. She described how

attorneys edit the documents:

We can code the documents. We can also look at comments other people have

placed on the documents in terms of their relevance, their priority, whether they

are key documents, whether they're responsive to any discovery we've received.

That helps this law firm and the other law firms in terms of working together to

understand what's important in the documents, what's not important.

Andrew also spoke of editing documents using real-time editing. He said, "I can have

editing and control, and I can make changes to your thesis as you and I talk. I do that

often." He also assigns virtual team members to collaboratively create "root cause

analysis" documents that succinctly retell how issues are resolved.

Rebecca reported a positive and negative experience with editing documents via

technology. She expressed frustration when she edited a press release virtually and the

original writer of the release declined to make one of her suggested changes. She said, "If

we had been sitting together and I would have been able to say to them what I just said to

you, I think it would have made more sense. They would have said, 'Oh yeah, okay. So

then let's change that.'" Rebecca also recounted a much more positive experience with

writing an op ed piece with her direct supervisor. They each viewed the document while

they talk about it on the phone, and Rebecca made changes to it. She said, "By the end

we're both fired up and we think it's great and we think we're great and you know we're

happy with the product."

Planning

Rebecca, Gigi, and John reported using collaborative technologies to plan aspects

of their virtual projects. Rebecca and Gigi frequently used IM. For example, Rebecca and

her virtual team members used IM to plan and execute their participation in a radio show.

She recalled one episode, "She and I are IM'ing back and forth while we do the show."

Referring to another episode, she said, "We were all communicating through instant

messenger so she was getting all her cues through the production staff via instant message. You know, 'Two minutes 'til we're back on the air.'…That was a really interesting virtual project." John reported using the document sharing and markup tool in *Groove* to annotate room layouts with team members to arrange the setup of an upcoming training session.

Summary

In summary, participants recalled a number of positive instances when collaborative technologies facilitated their informal learning. Participants cited virtual coaching and mentoring as particularly well mediated by technology. Participants also frequently discussed instances of knowledge sharing through various technologies such as IM, email, and online meeting tools, as rich sources of informal learning. Participants further discussed their occasional use of knowledge management systems to access shared documents and meeting replays though contributing to those systems was less frequent and inhibited by a lack of time to reflect upon and capture lesson learned. Other positive stories of informal learning involved making mistakes, problem solving, document creation and editing, and planning. In conveying all of these instances, the participants' ability to gauge which technologies were most appropriate for which work tasks was apparent and may have contributed to their successful informal learning experiences. The only way technology inhibited informal learning was in networking, perhaps because of the absence of trust that exists between people meeting for the first time through technology. The concept of trust in virtual social relations is discussed in an upcoming section, but in the next section I turn to the nature of virtual work and the contextual variables which impact virtual informal learning.

The Nature of Virtual Work

The nature of virtual work emerged as an over-arching theme during interviews and informs research question two: what cognitive, social emotional, motivational, and contextual variables affect the informal learning of virtual team members and how do collaborative technologies impact those variables. Insight into the nature of virtual work and these questions emerged as participants discussed their motivation for working virtually, their productivity, the type of job and person best-suited for virtual work, the importance of occasional face-to-face contact and visual cues, and advice they would offer to those considering a virtual work arrangement.

Flexibility as Motivation

The motivation to work virtually and positive sentiments about doing so stemmed predominately from one benefit: flexibility in work schedule and location. The freedom to work beyond the confines of a traditional eight-hour workday at an appointed location afforded many benefits. Rebecca said, "I'm so thankful for it…I was looking to continue to be an activist and be home with my kids and I was able to combine both things and I would not have been able to otherwise." When asked if he enjoyed virtual work, Andrew responded, "Absolutely. You know, I can play golf every Friday afternoon and no one knows it. I carry my cell phone and my PDA with me and I answer emails and I answer phone calls. That's good!" Kijana concurred, "It's also really nice not to have to be in a certain place at a certain time with the synchronous kind of communication. That's motivation." Other participants who work from home cited not having to get dressed to go to work and not having to commute to work as time saving perks which allowed them to spend more time with their children. Working from a place of their choice also allowed

them a better quality of life for themselves and their families. Michelle, who became a virtual worker after moving to a city three hours south of her company's headquarters, commented, "It's a bigger city, more to offer for the kids, better schools, things like that. Closer to my family, and my parents are aging, not aging so well, so I needed to be closer to help them out."

Increased Productivity

Participants working from their home office overwhelmingly viewed themselves as more productive than they are or would be if they were co-located with team members. Rebecca said, "You're not in an office where somebody's coming in to chit-chat with you or you're getting way laid by some silly meeting you have to go sit in…" David remarked that getting a cup of coffee when he's at home takes about five minutes whereas when he's at his company's work site "people stop by your desk and say let's get a cup of coffee and forty five minutes later you're sitting back down at your desk." David further emphasizes his productivity by stating that working virtually from home allows him to work even though he or his children are ill. Victoria also mentions that virtual work reduces travel which has "a lot of down time." Productivity is thus increased. Charles, who in addition to working virtually also manages a number of virtual teams, remarked:

> I'm fully convinced as a supervisor, I not only get more productivity out of them, I get more actual hours out of them. But it's not because I demand it, it's because there's an appreciation of, hey, you know, maybe I need to take and pick up my kids from school every day, so there's a time during the normal work day that I'm not available, but I'm allowed that flexibility because I'm going to work for them

from 8 PM to 9 PM, that type of thing. So I think that's powerful on both ends, both for the organization and for the individual.

An interesting caveat to the increased productivity of virtual work was raised by David and Michael. David warned, "You have to have the discipline to stop working. One of the problems with working from home is that you never leave work." Michael relayed a similar message in his comments about virtual work, "It's a very good experience, so I would absolutely recommend to do it, but again it's like gunpowder. It can be dangerous, so you have to know what you're doing, why you're doing it and make proper use."

Though the virtual workers' perception of their own productivity may be positive, others may not share the same perception. David expressed his frustration that co-located employees viewed him as "sitting there in your pajamas;" while Rebecca resented the speculation held by other workers that she could do more networking if she were located in the same city/state as her organization and thus increase her production.

A Certain Kind of Person, A Certain Kind of Job

In talking about the nature of virtual work, participants indicated that virtual work is best suited for certain kinds of jobs and certain kinds of people. For instance, Rebecca, who considers herself a writer at heart, pointed to writers as well-suited for virtual work, because "That's such a solitary practice and being able to write like whenever you want to, not necessarily nine to five in between meetings, is such a blessing. Victoria further clarified this point, "If their job is like a secretary, their job may not be encouraged to work from home. But consultants like myself, there are almost none of us left in the building." Eric echoed that virtual work is a common element of his job as a recruiter

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because of the boundaryless nature of collaborating with other recruiters and recruiting dispersed candidates.

Participants identified the following characteristics as essential to the virtual worker: self-regulated, self-disciplined, and self-motivated. John summed up this notion when he said, "They have to be very self-regulated. They have to be very motivated. They have to be able to prioritize tasks, operationalize those tasks in a step-wise fashion, and be able to sequence them…so they can be effective." Michael pointed to the importance of maturity and the personality in staying focused. Rebecca expresses concern for extraverts who engage in virtual work:

> People who are really extraverted who really need to feed off of other people and who really need a group dynamic to really get going, aren't self-starters, aren't really self-motivated, or just people who think better in a group, there's a real physical energy in the room for them to tap. I don't know that I would encourage it.

Rita emphasized the importance of being technically savvy so that technology does not stand in the way of work.

Other participants acknowledged, however, that not all virtual workers will have the same characteristics, abilities, or experience. Kijana, for instance, when asked about the importance of self-regulation and discipline, stressed the importance of allowing for individual differences in work style. She said:

> I think a lot of what you are as a worker face-to-face is okay to be in a virtual team also. I think the more that you can allow people to have different ways of working...be willing to work with them in that flexible way.

Eric and Gigi further elaborated on the impact of technology and individual differences in collaborative work. Gigi commented, "And you learn working in groups who's gonna use what technology. You immediately find out he never uses email…or he travels a lot. You find you gotta call him." Eric went further in acknowledging the fit between person and technology, "You need to use a few different kinds to figure out what works best for you and that person or persons." Finally, Michelle suggested that virtual work may be inappropriate for employees with little experience at their job, because they would need hands on coaching. She said:

> I don't think you can take someone out of college and put them in this type of
> role…it would be very difficult to bring that person up to speed without being
> able to be near them, without being able to be hands on.

Blended Work

Being hands on was also emphasized by participants referring to the benefits of working virtually while also conceding that some face-to-face contact between worker/worker and worker/client should be maintained. Victoria referred to this concept as blended work, drawing an analogy between blended work and blended learning. She said:

> We have something called blended learning. I think work also needs to be blended
> work…When the benefits of being there face-to-face outweigh the benefits there
> by phone or in a *Centra* meeting, or on *Sametime*, then you do it face-to-face.
> There are times when benefits outweigh all the technology in the world.

In discussing the importance of the worker/worker relationship, Kijana admitted, "I like it fine but that's only because I have plenty of physical face-to-face contact with people in

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other situations. I don't think I would like it completely if that's the only kind of team work I did." Michelle confessed:

> There are times when I miss my co-workers because, you know, work is sort of a social outlet too…so there are times when I miss my co-workers, but I would say at least ninety five percent of the time I'm very happy to be working from home.

Communicating through Visual Cues

The need for face-to-face contact was further emphasized by participants as they discussed the necessity of visual cues. Kijana told a story about how visual cues may have changed her approach to providing feedback to an author: "I think what happened is that for whatever reason I didn't pick up any of the cues maybe I would've picked them up face-to-face more easily—that this person was very tender about editing." David, who admitted to having a dry sense of humor delivered through facial expressions, recounted an instance when one of his virtual team members didn't respond well to him. He attributed their poor relationship to his sense of humor. Their relationship became positive after a face-to-face visit: "We had an offsite where it was a lot more casual. We had some drinks and it was a lot more joking. She was able to see the humor in action, and she kind of learned to understand it." Michael spoke adamantly about the need for visual cues and eye contact. He said:

> Well when you're in person you have eyes. You see the posture of people. You can tell much more how people are reacting to you. The point is technology is great, but it will never replace direct relationships…Without the help of vision, of the eye contact, everything else can be completely misleading…The lack of eye

contact unless you know a person very well is one of the key limitations of this

type of technologies.

Gigi insisted that meeting face-to-face helps develop a "three dimensional" relationship.

Manage Your Time and Expectations

Participants advised those considering virtual work arrangements to stay focused

by managing their time and to set expectations for communicating with team members.

For example, David advised, "You need to stay focused. The hard part is when you're on

an unpleasant task that you really don't want to get started on." Similarly, Michelle

attributed failures at virtual work to the inability to stay focused and exercise good time

management:

I know some people who have tried to work virtual or remotely and failed because

they couldn't actually stay focused on their work…You have to treat it just like

any other office job. I set my limits. I am not going to get up and leave this desk

until it's eleven thirty and it's time for lunch other than going to the bathroom.

In addition to staying focused, Michael warned against working without purpose:

Don't get distracted on other things like email. Do not work just for the sake of

generating email and information that other people won't be able to process…At

the end of the day keep in mind that you are the subject and the tool is just the

tool that allows you to do it.

John encouraged virtual workers to prioritize and sequence work tasks "so you're not

always wondering when the next ball is going to drop." He also recommended that they

"establish a certain frequency, you know, periodicity or a sufficient duration of live

communication intervals even if they're over the phone."

John's recommendation for setting expectations about communication between team members echoed in the comments of other participants. Eric emphasized the importance of setting communication protocols so there aren't excessive time lags between sending an email and receiving a response. Kijana advised that when team members receive an email or voicemail that they can't answer immediately they should respond saying, "I'm really busy with something I'll get back to you." She also commented that it's important to be very clear in your writing and if you receive an email that you don't understand "don't be afraid of saying that you don't quite understand." Michelle said, "When they have not responded to your email, pick up the phone and give them a call." Setting expectations like those mentioned by participants helps virtual team members know how and when to communicate. According to Andrew, setting expectations is an important element of success:

> If you're going to be successful in a virtual environment, you need to ask enough questions to make sure that you understand what it is that they are asking you to do, and what it is the company is trying to do and see how you can match your activity, so then you become self-motivated because you enjoy what you are doing.

Andrew admitted that the same is true whether you're working virtually from home or going into an office everyday.

Summary

In their discussion of the nature of virtual work, participants revealed a number of contextual factors that impact their work. For instance, they attributed their motivation for working virtually to the flexibility in work hours, and they perceived that working

virtually increases their productivity. They also recognized that workers who are self-motivated and able to manage their time and expectations are best-suited for virtual work. While citing the advantages of virtual work, participants also acknowledged the importance of visual cues and therefore advocated that work be supplemented by occasional face-to-face contact. Since informal learning is grounded in everyday work, these contextual factors not only impact virtual work but also virtual informal learning. Two contextual factors identified by participants as particularly germane to virtual work and informal learning were relationships and trust. I discuss these contextual factors in the next section.

<div align="center">Relationships and Trust</div>

Participants revealed that relationships between virtual team members and the clients they serve are gravely important and begin with a sense of trust. They also offered ideas for building trust and relationships when virtual. Consequently, this section informs the following research questions: How do team psychological safety, trust, and mutual knowledge relate to informal learning in the context of virtual work? What role do collaborative technologies play in supporting those relationships?

A Good Relationship Is a Necessity

Participants confirmed that a positive relationship facilitates work with virtual team members and clients. Michael stressed their importance when working virtually or co-located. He said, "A good relationship is always a necessity." Rita remarked about virtual relationships in particular, "It's good to have good working relationships with the company that you're partnering with when you're using a virtual application." John

provided a real-world example of how an established relationship can lead to comfort and facilitate work:

> It's very difficult to develop a rapport when we have a team of six people developing a scope document and you have to critique each other…If they have not worked with each other before…they don't feel comfortable enough to speak frankly, professionally, constructive criticism of the other person's work. But that is essential.

Michael shared his thoughts, "If you know a person really well, you can have lots of remote activity and you are pretty much in synch." Though unable to provide a specific instance in which a negative relationship impacted his work, David admitted relationships have some effect, "Just like any relationship where there's uneasiness or awkwardness with two conflicting personalities, it makes work a little less pleasant."

According to participants, building a relationship involves getting personal, having face-to-face contact, and being courteous in virtual communications. Victoria and Kijana spoke of sharing personal information informally as being helpful to building relationship bonds. Kijana thought it useful to include informal comments when communicating like "the weather is great here or I'm really excited about your manuscript, but whatever the comments are, they're not formal. They're informal." Eric concurred, "You know having a little bit of small talk here and there and just getting to know what someone's about. And that I've noticed that's happened over the telephone in most cases when that relationship was established." Victoria and Kijana both made use of the online biographies of virtual team members to get to know their team mates and perhaps make personal connections with them.

Having some face-to-face contact is also important in building relationships. Gigi adamantly discussed the importance of "water cooler" experiences with team mates, "So if you don't have that water cooler experience or that coffee maker experience with this person, you…that barrier is even greater. If you have plenty of that, that barrier is very small." Andrew declared, "Even if you're virtual you still have to have some scheduled face-to-face because you have to establish a relationship. Working relationships don't go away just because you're virtual. You still need it." Victoria also insisted on the importance of face-to-face kick-off meetings at the beginning of projects in building trust among virtual team mates. Rebecca commented that having established an in-person relationship with a few members of her organization helped her when she began working virtually because "they had a face to put with a name."

Exchanging courtesies and humor in virtual communications are also informal ways of building trust. Rita suggested:

Try to maintain a positive relationship…It just goes back to being courteous to the individual. You have to use certain courtesies when you're communicating…like 'thank you' or asking a person questions, asking if they can do something instead of 'do this for me.'

Kijana concurred that the way you approach someone, for instance the language you use, impacts the relationship that is built.

I think you build that relationship. And you build it by the way you invite the manuscript, the information you ask of the person, the way that you approach them—changes about their manuscript or ideas about if they're doing a series of

columns…using conditional and less aggressive command verbs I think really helps build the kind of persona that will help people build a relationship with you. Rebecca suggested using humor to build bonds, "I think humor is a really good way to forge a bond between two people." Andrew also mentioned humor as important but identified trust as a prerequisite to using it as it may be misinterpreted:

> You can't have any level of humor unless you have a team that knows each other and trusts each other. A virtual team must trust each other, and you only get that through a relationship.

Like Andrew, other participants identified that trust as an essential component in building a relationship and facilitating work.

Proving Trustworthy

Trust, an essential component of building a relationship, is crucial in working together from a distance. John elaborated, "Got to have trust and rapport, then you can work distributive much more effectively." Victoria credited trust with the number one most important ingredient to accomplishing work, "I think that it is number one, that you need to trust, and you need to be trusted." Kijana offered a multi-level perspective about trust:

> There are levels of trust…I think that some of the reasons that trust builds in a relationship have to do with the relationship itself, with the experience of the person…Sort of a notion of trust I think is a continuum, and it's based on what needs to be accomplished….When I have a conversation with somebody I hardly know and I'm building trust I still may be able to accomplish my task without getting to a very deep level of trust.

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Her comments imply that certain tasks require deeper levels of trust and that trust is built based on the types and frequency of experience one has with another person.

Even though participants expressed that trust is best built from face-to-face contact, they acquiesced that creating a trusting relationship virtually is possible and is predicated on integrity. Charles relayed a story about creating a trusting relationship virtually:

> I can think of some team members where my initial interaction for the first three months of knowing them was entirely virtual…By the time we met for the first time, it was very clear that we knew each other's personality…that trust relationship had existed.

Victoria spoke of the importance of integrity to building trust, "You do that by building credibility and by delivering on your commitment…You need to deliver on your word and ensure that your client is successful…Then always, always follow up." Andrew provided an example, "If I called you up at eleven o'clock today and said, 'I'm sorry. I can't make it.' The next time I set up an appointment, do you trust me or not?"

Summary

A healthy relationship built from a sense of trust inspires virtual team members to share knowledge and collaborate. Participants expressed that trust-building can be mediated by technology. Strategies for virtual trust-building included setting and meeting expectations for work and communication and being courteous in virtual communications. Participants indicated that an initial, face-to-face kick-off meeting is a great way to jumpstart trust and relationship building among team members.

Organizational Context

In this section, I discuss themes derived from participant interviews as they relate to the following research question: How does the organization support or inhibit virtual team member learning that is informal and enabled by collaborative technologies?

Organizational Support

Organizational support is important to the day-to-day functioning of virtual workers. The most common form of support provided to participants by their organizations is access to technological tools. Interestingly, Eric revealed that access to certain tools, like handheld devices, is often contingent upon rank within his organization. Participants also indicated that their organizations have substantial financial investments in technological systems. Andrew commented on the impact of technological systems on organizational structures:

> A lot of companies have their IT department integrated into their senior
>
> management level…because they directly impact the bottom line of the company.
>
> That's why the world of technology is becoming the enabling tool for market
>
> penetration as well as profitability.

Michael encouraged organizations to research virtual tools: "You need someone who is really looking and researching these tools and bringing them to your organization... People don't spend enough time to understand what other people need." David told of a failed grass-roots movement at his organization to keep an IM tool that employees found extremely helpful, but management insisted on removing it from the standard suite of office tools. He emphasized the importance of involving those who will be using the tool in its selection. Similarly, Andrew suggested organization keep up with the latest tools

and the needs of virtual workers: "I think it's important to note that you have to keep your finger on the pulse of what's going on so that you can always improve. If you get stagnate then you get behind."

Managing Virtual Teams

Kijana, Andrew, Michael, Victoria and John provided success stories and advice for managing virtual teams. They emphasized the importance of setting expectations for communication, team roles, and project milestones. Kijana minimized the impact of tools as compared to the impact of an effective leader:

> Tools cannot make a good relationship or fix a bad one. What you build depends on your style of leadership, your belief in the way people should work together, the group members' understanding of their roles, the norms that evolve within the group and rules that are created by them.

Andrew and Victoria hold kick-off meetings where they set expectations for virtual work from the start of the project. For instance, Andrew establishes "email do's and don'ts" and notifies the team that he will check-in with them daily or weekly and hold monthly results meetings. Victoria negotiates the following:

> How are we going to communicate? Are we going to set up a team room? How are we going to make changes? What are we going to do to ensure we're successful in achieving our common goals? So a lot of it has to do with good project management, and a lot of it has to do with excellent communication…

Like Andrew and Victoria, John sets clear deadlines and milestones, making virtual workers accountable for delivering on time and avoiding "project creep." Michael also pointed out the importance of setting team member roles especially during virtual

meetings. He expressed that virtual meetings require "a defined leader driving the discussion and of somebody taking the action item."

Summary

The organizational context in which virtual team members work and learn affects their success. The most important form of organizational support expressed by virtual team members was technological support. Some participants advised that organizations should not only provide collaborative technologies to virtual workers but also involve them in the selection and adoption of the tools that fuel their work and learning. Otherwise, organizations may run the risk of inhibiting the work of virtual workers by selecting technologies that do not meet their needs. Only one participant's organization had other incentives, such as performance bonuses, in place specifically for virtual team members. Other participants were subject to the same support mechanisms as co-located employees. The organization can also be supportive by providing managers well-versed in the needs of and strategies for managing virtual team members.

Conclusion

In this chapter, I presented the findings of twelve interviews with virtual team members conducted to explore how collaborative technologies influence the informal learning experiences of virtual team members. Table 4.1 summarizes and groups these findings by research question. In the next chapter, I discuss these findings in relation to the review of the literature in Chapter Two. I also list implications for research and practice.

Table 4.1 Summary of Findings

Research Question 1: *How do virtual team members describe their informal workplace learning experiences as facilitated by technology?*   • Virtual team members described various instances of their informal workplace learning experiences as facilitated by technology. Informal learning experiences included instances of **virtual coaching, mentoring, and networking; knowledge sharing and management; making mistakes; problem solving; document creation and editing; and plannin**g.

Research Question 1a: *What are the perceptions of collaborative technologies among virtual team members?*
 • Virtual team members described their perceptions of collaborative technologies as followings:
     o Participants identified **email** as the most commonly used technology and characterized it as both a source of misconception and reflection. They viewed time lags inherent in this asynchronous form of communication both positively as they afforded time for reflection and negatively as they generated false assumptions as to why email responses were slower than expected. The difficulty in communicating tone through this text-based media also generated misconceptions.
     o **IM** was the second most commonly used technology and considered appropriate for short, quick exchanges. Its only drawback was its synchronous nature can be distracting and interrupt work.
     o Participants perceived **audio tools**, such as the telephone and teleconferencing, as more useful for complex tasks than email or IM, because tone can be communicated.
     o **Video tools**, such as videoconferencing and webcams, and have benefits and drawbacks. A very strong benefit is its ability to convey valuable visual cues, such as body language. Drawbacks include prohibitive cost, technical difficulties, and scheduling across time zones.
     o **Web-based collaborative tools**, such as discussion boards, were used to archive lessons learned, project information, and personal facts about virtual team members.
     o Participants cited using **knowledge repositories** housed on organization internets or intranets to access and contribute to work-related documents.
     o **Desktop sharing** is an important tool for collaboration that requires visual aids.
     o **Integrated collaborative suites** that combine these tools plus the ability to monitor and manage virtual projects are ideal.

Research Question 1b: *How do collaborative technologies facilitate or inhibit informal learning among virtual team members?*
 	
   • **Informal workplace learning is a byproduct of everyday work tasks** as virtual team members collaborate on everyday work tasks**.** As a result, collaborative technologies facilitate or inhibit informal learning in the same ways they facilitate or inhibit work.
   • Technology's ability to facilitate or inhibit informal learning situated in work tasks is dependent on the **match between task and technology.** For example, simple, quick information exchanges are best accomplished by technologies such as email or IM; whereas, more complex tasks like problem solving or planning are best accomplished by desktop sharing, video or telephone conferencing. A mismatch results in effective communication and inhibits work and informal learning. It is important to negotiate at the start of a virtual work relationship or project which technologies will be used for which tasks.

Research Question 2: *What cognitive, social, emotional, motivational, and contextual variables affect the informal learning of virtual team members? How do collaborative technologies impact those variables?*
 	
   • Participants revealed the importance of **social relations, technological support, self-motivation, and flexibility** in work hours as contextual variables that impact their informal learning experiences.
   • Collaborative technologies fuel their ability to build **relationships and trust** with their team members which, in turn, enhances their informal learning and collaboration.

Research Question 2a: *How do team psychological safety, trust, and mutual knowledge relate to informal learning in the context of virtual work? What role do collaborative technologies play in supporting those relationships?*
 	
   • A **healthy relationship** built from a sense of trust inspires virtual team members to share knowledge, and collaborate.
   • Participants expressed that trust-building can be mediated by technology. Strategies for virtual trust-building included **setting and meeting expectations for work and communication and being courteous in virtual communications**. An initial, face-to-face kick-off meeting is a great way to jumpstart trust and relationship building among team members.

Research Question 2b: *How does the organization support or inhibit virtual team member learning that is informal and enabled by collaborative technologies?*
 	
   • The most important form of organizational support expressed by virtual team members was **technological support**. Organizations should not only provide collaborative technologies to virtual workers but also involve them in the selection and adoption of the tools that fuel their work and learning.
   • Only one participant's organization had other **incentives**, such as performance bonuses, in place specifically for virtual team members. Other participants were subject to the same support mechanisms as co-located employees.
   • The organization can also be supportive by ensuring **leaders are skilled in managing virtual team projects and team members**.

CHAPTER FIVE: DISCUSSION AND IMPLICATIONS

Introduction

The purpose of this study was to explore how collaborative technologies influence the informal learning experiences of virtual team members. In this chapter, I discuss the findings of twelve interviews with virtual team members and situate those findings within the literature surrounding virtual work, informal learning, and virtual informal learning. In chapter two, I summarized the literature in a model titled the virtual informal learning system. That model has been revised based on the findings of this study and it is shown in Figure 5.1. This chapter's discussion is organized according to the components of the revised model—the inputs, processes, and events that lead to virtual informal learning. Following the discussion, I discuss implications for practice and research.
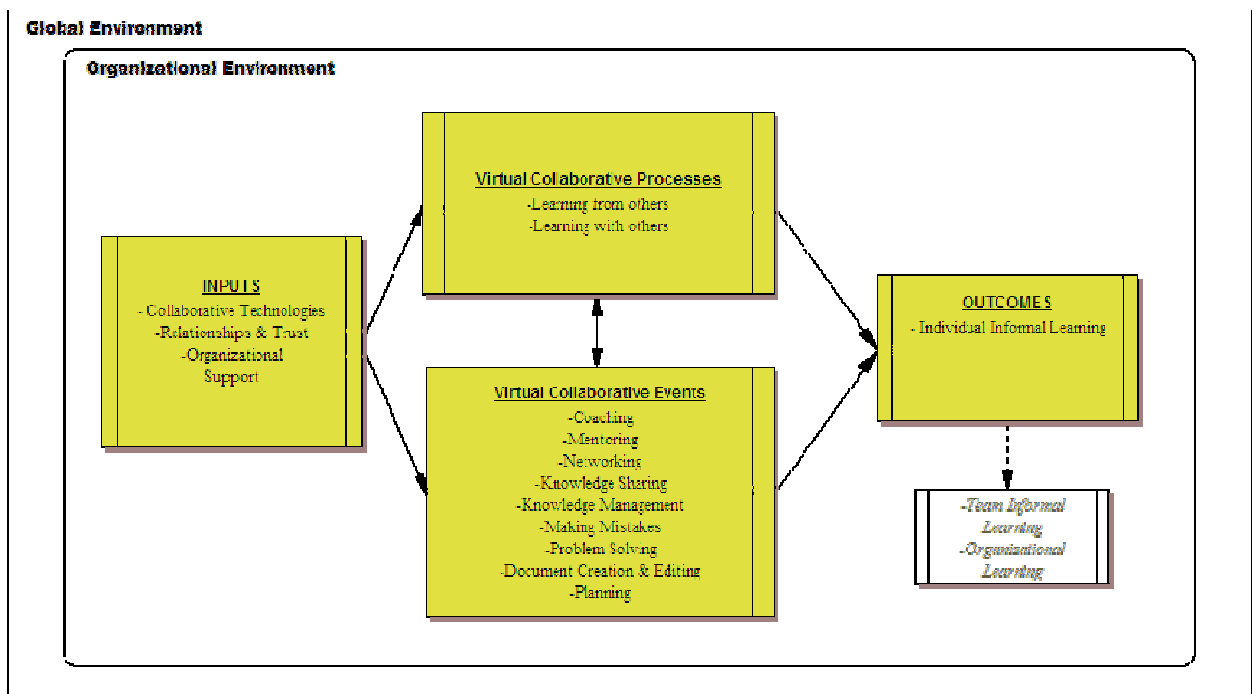

Figure 5.1 The Virtual Informal Learning System (VILS)

Inputs to Virtual Informal Learning

In my exploration of the literature, I identified collaborative technological

systems, time and space, trust, change, and rewards as inputs to virtual informal learning.

While a couple of study participants alluded to time and space, change, and rewards as

accelerants to virtual informal learning, collaborative technologies, trust, and

organizational support were overwhelming cited as inputs to virtual work and learning in

the findings of this study.

Collaborative Technologies

Participants identified a number of technologies as integral to their everyday work

and thus the informal learning experiences situated within that work. Text-based

communication technologies, such as email and instant messaging (IM), were cited as

most frequently used when quickly exchanging bits of knowledge, but participants also

identified limitations inherent in text-based technologies. For example, participants

attributed miscommunications of humor to the lack of visual cues and to time lags

between responses. Similarly, Cramton's (2001) research revealed that uneven feedback

cycles and difficulty in interpreting the silence of fellow team members negatively affects

the establishment of mutual knowledge.

Participants indicated that other more collaborative text-based technologies, such

as discussion boards and Microsoft Word with the Tracked Changes and Comments

features enabled, were integral to their everyday work. These collaborative text-based

technologies allow teams to archive personal and work-related discussions and

information and to participate equally during collaborative work. Groupware research

conducted in the late 1980's and 1990's confirmed that computer-mediated teams

participate more equally than face-to-face teams (Coovert & Thompson, 2001).

Searchable knowledge repositories housed on the internet or on intranets are also a good

source of information sharing and archiving (Sole & Edmondson, 2002) and participants

confirmed having and using them in their everyday work.

Participants also reported audio and video based technologies, such as

teleconferencing and webcams, as helpful especially in solving problems or making

decisions and in communicating visual cues which, in turn, lessen the miscommunication

often experienced when using text-based technologies. Participants suggested that an

increase in formality occurs when these technologies are used and that their synchronous

nature presents scheduling difficulties. Desktop sharing combined with audio is also

powerful for troubleshooting and demonstration. A lack of literature related to the use of

audio and video in virtual work exists, but more and better studies should be conducted to

further investigate its importance.

According to research (e.g., Coovert & Thompson, 2001; Grudin & Poltrock,

1997) and confirmed by participants, systems designed specifically for virtual teamwork

that integrate text, audio, and video technologies have numerous benefits such as

asynchronous and synchronous communication, knowledge and document sharing,

collaboration, and task coordination. Grudin and Poltrock's (1997) research identified the

lack of media integration as a technical challenge to groupware's success. With the

advent and adoption of integrated technology suites, such as *Groove*, this challenge

should fade. Furthermore, it is interesting to note that participants rarely mentioned ease-

of-use or other technical factors as barriers to work or virtual informal learning. Ttheir

discussions of virtual work centered on the work itself and less on the technologies used

to facilitate it. It may be that accomplishing work has become the primary focus among

virtual workers as technology gradually becomes more transparent and its use more

instinctual.

The findings of this study also identify a continuum between technology and task

as I have illustrated in Figure 5.2.
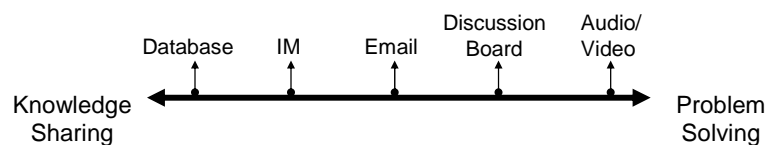
Figure 5.2 Technology/Task Continuum

As illustrated, certain technologies are more appropriate for certain tasks—the more

complex the task, the more robust the technology. For example, participants cited the

appropriateness of certain technologies, such as email and IM, for quick knowledge

sharing and certain technologies, such as desktop sharing, teleconferencing, or

videoconferencing, for solving problems or making decisions. They conveyed the need to

use more robust technologies for complex tasks because of their ability to communicate

socio-emotional cues. The task portion of the continuum in some ways mirrors Benjamin

Bloom's (1956) hierarchy of learning behaviors within the cognitive domain: knowledge,

comprehension, application, analysis, synthesis, and evaluation. Andreissen (2003) made

reference to this notion of a match between tool and task when he named it as one of five conditions which drive the effectiveness of technology as an enabler of collaboration.

Overall, participants perceived collaborative technologies as helpful in facilitating virtual work processes that provide the context for informal workplace learning, especially when there is a good match between task and technology. The also identified healthy working relationships built on trust and organizational support as inputs to virtual informal workplace learning.

Relationships and Trust

Participants emphasized the importance of establishing a good relationship with team members and clients because relationships facilitate work, collaboration, and learning. While they acknowledged technology's ability to facilitate relationships virtually, participants admitted that relationships are best formed face-to-face with "water cooler experience". If face-to-face contact isn't possible, then strategies for bonding virtually cited by participants included:

- Holding an initial, face-to-face kick off meeting to jump start relationship-building

- Exchanging personal information at the beginning of emails or posting bios to discussion boards or intranets to establish common ground

- Being courteous in all communications and couching words or phrases so that they are well-received

- Using humor but only after a positive relationship has been established and mostly through video so that visual cues are communicated and misinterpretations are less likely

Jarvenpaa and Leidner's (1999) and Vroman and Kovacich's (2002) research supports the first strategy of sharing social relational information. Vroman and Kovacich also emphasized the need for computer-mediated communication environments to support virtual teams in the group development process also experienced by co-located teams, specifically those of forming, storming, norming, performing, and transforming.

Both the literature and study participants named trust as a crucial component of building a healthy working relationship building that facilitates work and informal learning (Ashton, 2004; Cheetham & Chivers, 2001; Day, 1998; Marsick & Volpe, 1999; Sambrook & Stewart, 2000; Tikkanen, 2002). Participants indicated building trust and relationships virtually *is* possible and predicated by integrity, defined as keeping commitments to team members and clients. Integrity is fostered by setting expectations early in the project, such as communication protocols, and following through with them (King & Powell, 2006; Vroman & Kovacich, 2002). Jarvenpaa and Leidner's (1999) suggestions for forming and maintaining trust were echoed by participants: task-oriented communication supplemented by social communication, consistent responses to members, and explicitly expressed enthusiasm and commitment to project goals.

Organizational Support

Organizational support provides the foundation upon which virtual work and learning is built. Predictably, participants cited access to technology as an important form of organizational support for their work. In her research, Ellinger (2005) named access to work tools and resources, such as computers, the Internet, and software, as a characteristic of an organizational culture conducive to informal learning. Surprisingly, participants mentioned organizational support in the context of their work but not in the

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recollection of their informal learning experiences. The one exception would be in reported instances of informal coaching.

Collaborative technologies make virtual work possible and participants expressed their gratitude for them. They also mentioned the need for technologies used in the workplace to be accepted by virtual workers and suggested organizational leaders are proactive in researching the latest tools and garnering acceptance of workers in their adoption. Andriessen (2003) echoed this sentiment as he listed individual acceptance and choice of tools as a condition driving technology effectiveness. Grudin and Poltrock (1997) recommended participatory design approaches and research studies to design more effective technology.

Participants indicated that managers of virtual teams have a considerable influence in their success. Vroman and Kovacich (2002) agreed, "The leadership has a role in facilitating process, presenting organizational structure and goals, focusing the team, and managing the logistics" (p. 164). Managers should set expectations for communication, team roles, and project milestones, ideally at project kick off meetings. King and Powell (2006) suggested an "initial contract discussion among members of the team enables them to reflect upon and share their expectations and hear others' ideas" (p. 2). Doing so may help build mutual knowledge (Cramton, 2001), relationships and trust (Jarvenpaa et al., 1998), and skill in matching task and technology. More research is needed concerning the role of virtual team managers, because they hold such influence over team success.

Implications for Research and Practice

There are a number of implications for research and practice derived from the findings of this study related to the inputs of or contextual factors that cultivate virtual informal workplace learning. Since collaborative technologies, relationships and trust, and organizational support and leadership provide the context within which virtual informal learning occurs, researchers should design and conduct studies that further investigate the context of virtual work with these inputs in mind. This study was exploratory and therefore did not seek to discover in-depth findings of how contextual factors influence work and learning. More in-depth research should be conducted to uncover the nuances of each of these factors and discover what other contextual factors exist. Research studies using quantitative, qualitative, or a mix of methods in an actual organization would be ideal and might remedy the failure of a number of studies cited in the literature review that were conducted at a university with university students instead of at authentic work settings. Such contextual research might also add to the theories and models of informal workplace learning, for instance the renowned Marsick, Volpe, and Watkins model (1999), which established but does not detail the influence of context of informal learning. Future research studies might also investigate members of the same virtual team and the impact of various factors such as the level of expertise of virtual workers and the number of virtual projects assigned to a virtual worker.

The findings of in-depth research into the contextual factors or inputs that frame virtual informal workplace learning could inform practitioners about how to support virtual workers and enhance their informal learning experiences. The findings of this exploratory study provide practitioners with a place to start. As participants specified,

they should help virtual workers understand the importance of and strategies for building

relationships and trust and guide them in choosing appropriate technologies for work

tasks. Managers of virtual teams need to provide this leadership and so must be

knowledgeable in these matters as well. Organizations should also dedicate a staff

member to researching the use and preferences of technology among virtual team

members and recommending upgrades to old technologies or proposing the use of new

technologies. Providing integrated collaborative technology suites that include

technologies recommended or approved by virtual workers is critical to their success.

<center>Virtual Processes and Events that Lead to Informal Learning</center>

The virtual processes and events that led to informal learning among the virtual

workers interviewed in this study verified some of those identified in the literature.

Participants learned informally with others (Billett, 2001; Cheetham & Chivers, 2001;

Conlon, 2004; Day, 1998; Michael Eraut et al., 1998; Leslie et al., 1997; Sambrook &

Stewart, 2000; Tikkanen, 2002; Vernon, 1999) and from others (Billett, 1995; Cheetham

& Chivers, 2001; Conlon, 2004; Michael Eraut et al., 1998; McDowall-Long, 2004;

Sambrook & Stewart, 2000) as they engaged in work events such as virtual mentoring,

coaching, knowledge sharing, criticism, problem solving, document creation/editing, and

planning.

Participants discussed episodes of virtual informal mentoring and coaching as

sources of informal learning. Informal mentoring and coaching took place through the

use of knowledge repositories, email, IM, and the telephone. Participants reaped the

benefits of informal mentoring as described by Bierema and Merriam (2002), which

included its ability to foster relationships across boundaries of time and geography and its

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time efficiency and convenience. Virtual networking did not fare as well as virtual informal mentoring and coaching as participants revealed that virtual networking was not as effective as face-to-face networking.

In the literature, knowledge sharing and management are identified as significant sources of informal workplace learning (Ashton, 2004; Ellinger, 2005). Participants reported that knowledge sharing occurred on a one on one basis through IM, email, telephone, and knowledge repositories, and in groups via webcasts, teleconferencing, discussion boards, knowledge repositories, and task management systems.

Participants recounted instances of attending live knowledge sharing events, like webcasts, more often than accessing or contributing to stored knowledge. A few participants reported learning informally from accessing and applying stored information, but how rarely knowledge management was cited as a source of learning was surprising given the amount of literature devoted to the topic and the claim that knowledge management are significant sources of informal workplace learning. In few instances, participants reflected on their performance or a project engagement and codified that knowledge in knowledge repositories, but a lack of time usually kept most participants from it. Lack of time implies the need for organizationally sanctioned reflection time to capture and store lessons learned, especially considering the insistence by informal learning theorists that reflection (Beckett & Hager, 2002; Conlon, 2004; Enos et al., 2003) and making tacit knowledge explicit (Ashton, 2004; Ellinger, 2005; Herrmann et al., 2003; Thomas et al., 2001) are rich sources of informal learning. In Figure 5.1, I illustrated the slight connection found in this study between instances of individual,

virtual informal learning and team and organizational learning by the dashed line and grayed text color.

Participants acknowledged other sources of informal learning not identified in the literature such as criticism, problem solving, document creation/editing, and planning. Participants recognized the importance of putting egos aside in order to learn from the criticism of others. Virtual problem solving occurred using more robust technologies such as desktop sharing, telephone and video conferencing. Collaborative document creation/editing using Word or in databases spawned "virtual conversations" and equal participation among team members. Planning events virtually, like a radio show and or a foreign exchange program, using IM and document sharing was reported as a source of virtual informal learning.

Implications for Research and Practice

There are a number of implications for research and practice derived from the findings of this study related to the virtual processes and events that lead to informal learning. Since this was an exploratory study, I did not conduct an in-depth investigation into any one process or event that resulted in informal learning, but doing so is a worthy endeavor for future research. Qualitative studies that employ methods of observation as well as in-depth interviews may provide richer results into one or each of these processes and events, since informal learning is often tacit (Marsick & Watkins, 1990). Observations by researchers particularly attuned to learning processes would prove fruitful for investigating informal learning beyond what could be derived by interviews, because participants in this study had difficulty articulating their learning. They viewed many of their informal learning experiences not as informal learning but simply as work.

Even when provided with a definition of informal learning, they continued to struggle with determining what was considered informal learning. A researcher skilled in observing instances of informal learning may uncover deeper levels of analysis than may be possible through self-report interviews.

Practitioners are able to use the findings of this study related to the processes and events that lead to informal learning in a number of ways. Organizational leaders should encourage and reward virtual workers who engage in the processes and events identified in this study as leading to informal learning. For example, informal virtual mentoring could be incentivized by awarding virtual workers with performance bonuses for capturing lessons learned from virtual mentoring relationships and uploading them to a searchable knowledge management system so that others can learn from their relationship (Herrman et al., 2003). Providing virtual workers with time to do this would also be required, as participants indicated that lack of time was their primary reason for not contributing to knowledge management systems. Organizations should also ensure that virtual workers have the technologies in place that they need to engage in other informal learning events (Garavan, 1997) such as problem solving, planning, and collaborating on work products.

<div align="center">Conclusion</div>

The purpose of this study was to explore how collaborative technologies influence the informal learning experiences of virtual team members. In this chapter, I discussed the findings of this study in relation to literature surrounding virtual work, informal learning, and virtual informal learning. Inputs revealed in this study as critical to setting the stage for virtual informal learning are integrated, collaborative technological systems;

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positive relationships and trust; and organizational support and virtual team management. Having these inputs in place fosters the processes and events within which informal learning occurs. Those processes are learning from and with others and occur during events of virtual mentoring, coaching, knowledge sharing, criticism, problem solving, document creation/editing, and planning.

This study's strongest recommendation is that researchers should investigate in greater depth the contextual factors within which virtual informal workplace learning is situated and the processes and events that spark it. Practitioners can then implement the findings of those investigations to increase the informal learning of virtual workers. Researchers might also work in conjunction with practitioners to determine if increases in informal learning lead to increased performance among virtual workers.

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APPENDIX A: SAMPLE OF RESEARCH STUDY MATRIX

Author/Year/ Purpose/Significance	Framework/Methods	Findings/Future Research	Implications/Critique
Ellinger 2005 Contextual factors influencing IWL; how is IL facilitated, encouraged, supported, and nurtured in the W	Qualitative case study; Marsick and Watkins model as framework; 13 participants; critical incident technique, semistructured in-depth interviews (fieldnotes); initial coding; narrative portraits; constant comparative; themes	Pos org factors influencing IL: learning-committed leadership and management, internal culture committed to learning, work tools and resources, people who form webs of relationships to learning. Neg. factors: leadership and management not committed to learning, internal culture of entitlement that is slowly changing, work tools and resources, people who disrupt webs of relationships for learning, structural inhibitors, lack of time, too much change, not learning from learning	Points to technology as a positive AND negative org factor influencing IL. Also discusses importance of "webs of relationships for learning" (collaboration); Good justification for my research in implications section Critique: doesn't provide any detail on *how* virtual technology impedes or diminishes personal communication
Cheetham 2001 Sought to identify the particular kinds of informal experiences practitioners found formative in their competence acquisition	Mixed methods; 80 interview participants who were practitioners from 20 professions; 372 surveys; rated forms of informal learning that helped them become fully competent	Participants said top three forms of informal learning that helped them develop competency: 1) on the job learning, 2) working with experienced colleagues, 3) working as part of a team. Interviewees identified collaboration, networking, teamwork, and learning through articulation and teaching others as significant sources of their professional development.	Great theory section with research on modeling, coaching, mentoring; tells benefits of collaboration and team work; lists qualities of supportive informal learning environments; talks about the socio-emotional factors (TPS) of teamwork. Offers taxonomy of informal learning methods which I can use to lead my interviewing and observation. Findings support Bandura. Critique: doesn't talk about technology or how virtual work affects competency development
Skule 2004 Sought to identify the conditions that are most conducive to informal learning at	Quantitative; surveyed 1500 private and public Norwegian employees	Seven learning conditions for informal learning: change, demands, managerial responsibilities, professional contacts, feedback, management support for learning, rewarding proficiency	Good justification for IWL; discusses its importance in public policy in Europe; Justifies need to identify factors that affect IWL Critique: IWL is too complex for

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APPENDIX B: PARTICIPANT CONSENT FORM

I, _____, agree to participate in a research

study titled "INFORMAL LEARNING AMONG VIRTUAL TEAM MEMBERS"

conducted by Frankie S. Jones from the Department of Educational Psychology and

Instructional Technology (706-255-3935) under the direction of Drs. Thomas C. Reeves

and Janette R. Hill, University of Georgia (706-542-4035). I understand that my

participation is voluntary. I can choose not to participate, and I can stop taking part

without giving any reason and without penalty. I can ask to have all of the information

about me returned to me, removed from the research records, or destroyed.

The reason for this study is to explore how collaborative technologies enhance or

inhibit the informal learning of virtual team members.

If I volunteer to take part in this study, I will be asked to do the following things:

1. Use a reflection guide to reflect on the informal learning experiences I have had

   during my virtual work (minimum of 30 minutes).

2. Participate in one audio-taped interview (maximum of 90 minutes). The particular

   location and time of the interview will be arranged at my convenience.

3. Participate in a follow up interview, if necessary (maximum of 30 minutes). The

   particular location and time of the interview will be arranged at my convenience.

4. Review a summary analysis of data gathered from my interview and notify the

   researcher if my comments are misrepresented in any way (30 minutes).

I will not receive any incentives. I will not receive any direct benefits. No

discomforts or stresses are expected. No risks are expected, but breach of confidentiality

in any study is a possibility. The following steps have been taken to minimize this risk.

Any information that is obtained in connection with this study and that can be identified with me will remain confidential unless required by law. My interview tape will be labeled by my pseudonym, kept confidential, and stored in a locked cabinet in the researcher's home office. It will be destroyed by August 2010. My pseudonym will be used for the purpose of transcription, data analysis, and in any publications. Any documents linking my name with my pseudonym will be destroyed by August 2007.

The investigator will answer any further questions about the research, now or during the course of the project (706-255-3935).

I understand that I am agreeing by my signature on this form to take part in this research project and understand that I will receive a signed copy of this consent form for my records.

_____	_____
Frankie S. Jones	Signature Date
706-255-3935	
fsjones@uga.edu	

_____	_____
Name of Participant	Signature Date

Please sign both copies, keep one, and return one to the researcher. Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu.

APPENDIX C: REFLECTION GUIDE

<u>Directions</u>

During your interview next week, I will ask you to talk about informal learning experiences that you've had while working virtually. Informal learning is learning that occurs outside of a formal training setting. It is usually unplanned and occurs as you go about your everyday work. Examples include virtual mentoring, coaching, or networking; knowledge sharing and management; or reflecting on lessons learned with your team members.

Using the questions below, begin thinking about specific instances of informal learning that have occurred during your work and how collaborative technologies have facilitated or inhibited those experiences. Collaborative technologies are all types of technologies that help you accomplish work with your virtual team members. They include email, handheld communication devices, video/audio conferencing, virtual meeting spaces, electronic whiteboards, and even your cell phone and telephone.

<u>Instances of Informal Learning</u>

- Tell me about 3-4 instances when you learned something while working on a project with your virtual team members.

- What did you learn during each instance?

- How did the technologies you used enhance or inhibit your learning?

- How did your relationship with your team members influence your learning?

APPENDIX D: INTERVIEW PROTOCOL AND GUIDE

Interview Protocol

1. Begin with the following opening statement:

    Thank you for agreeing to participant in this study exploring how
    collaborative technologies enhance or inhibit the informal learning of virtual
    team members.

    What I'm basically trying to discover is how technology helps you collaborate
    with your team members and what, if any, learning occurs during that time.
    Before we begin let me clarify what I mean by informal learning and by
    collaborative technologies.

    Informal learning is learning that occurs outside of a formal training setting. It
    is usually unplanned and occurs as you go about your everyday work.
    Examples of informal learning can include informal mentoring and
    networking, knowledge sharing and management, and reflection.

    Collaborative technologies are all types of technologies that help you
    accomplish work with your virtual team members. They include email,
    video/audio conferencing, virtual meeting spaces, electronic whiteboards, and
    even the telephone.

    So keep those definitions in mind as we go through the interview questions.

2. Remind the participant that you will be tape-recording the interview; that all
    responses will remain confidential; and of his/her right to terminate the interview at
    any time.

3. Inquire about or thank them for returning the consent form.

4. Ask the participant to choose a pseudonym.

5. Turn on the tape recorder and begin the interview. Follow the interview guide, but
    remain open to emerging topics. Take fieldnotes and probe throughout.

6. Close the interview by thanking the participant and turning off the tape recorder.
    Inform them about next steps like transcription, summary analysis, and dissertation
    sharing.

Interview Guide

Introductory/Background
- Please describe your educational background for me and what led you to this organization.
- How many years at this organization? What do you think of the organization?
- Please describe your job role.
- How long have you been a member of a virtual team? In general, do find virtual work enjoyable?

Instances of Informal Learning
- Tell me about 3-4 instances when you learned something while working on a project with your virtual team members.
  - Examples include virtual mentoring and networking, knowledge sharing and management, and purposeful reflection such as lessons learned documents.
- What did you learn during each instance?
- How did the technologies you used enhance or inhibit your learning?
- How did your relationship with your team members influence your learning?

Probing Questions
- Virtual Team Members
  - Tell me about your current virtual project.
  - What is each team member's role?
  - Tell me about your teammates.
    - Where are your virtual team members located?
    - What are their personalities like?
    - Do you enjoy working with them?
    - Have you been able to establish social relationships with them?
      - What types of technology have helped?
  - What is your role on the team?
    - Is there one person that the project requires you to work with more than others?
- Perceptions about Collaborative Technologies
  - How do you feel about technology in general?
  - Describe how you use technology to do your job.
    - Describe how you collaborate with your virtual team members.
      - Team meetings
      - Accomplishing work goals
    - What types of technologies do you use?
    - Tell me what you think about each of those technologies?
      - How are they helpful?
      - How are they a hindrance?
- Organizational Support

- What does your organization do or not do to support your virtual work? What incentives exist?
- If you could design a technological system for your organization to help virtual teams collaborate, what would it be like?

Closing Questions
- If you met someone who was considering becoming a member of a virtual team, what advice would you give them?
- Is there anything else you would like to tell me that you think I would find useful to this study?
- Next Steps

APPENDIX E: SUMMARY ANALYSES FOR EACH PARTICIPANT INTERVIEW

Charles
- He uses a number of technologies to accomplish his work goals including email, instant messaging, the telephone, and a web conferencing system. The web conferencing system integrates voice over IP, text chat, a whiteboard, desktop sharing, and video.
- Instances of informal learning:
  - Members of Charles' virtual team use components of the learning management system used to conduct online classes for the virtual high school such as threaded discussion boards and document sharing.
  - Informal learning resulted when virtual team members used desktop sharing to collaboratively debunk a problem in the administrative system of the LMS.
  - The team uses a repository to store documents and to post their birthdays, facts about themselves, and other things that would help team members get to know them.
  - Certain modes of communication can be detrimental to problem solving. Charles relays an instance of when instant messaging impeded the communication and resolution of a problem with a team member. He resolved the problem by ending the chat session and resuming the conversation in person the next day. Charles said the nature of the conversation was more appropriate for a face-to-face environment where nonverbal communication was possible and very useful.
- A trusting relationship is important among virtual team members. Trust forms virtually as it does face-to-face.
- Charles' organization is generally supportive but he wishes organizational leaders were more sensitive to the distributed nature of virtual work.
- Virtual work is not suited for all types of work.
- Charles wishes the "dropping by" and "eaves-dropping" aspects of face-to-face work could be somehow replicated in the virtual environment. They are potential sources of informal learning.
- Collaborative technologies extend the workday and therefore have the potential of increasing opportunities for informal learning and work during evening or weekend hours.
- Charles' virtual workers are very productive, perhaps because their schedules are flexible.

Michelle
- Working virtually allows Michelle a great deal of flexibility which is important considering she has three small children. She also saves time by avoiding the need to "get ready for work" and commute to an office.
- She established a working relationship with most of her virtual team members prior to becoming a virtual worker.

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- Michelle uses email, document sharing, a document repository, MSN messenger, and *WebEx* (supplemented with teleconferencing) to accomplish work.
- Informal learning instances:
  - Michelle once used IM to ask a colleague about the correct edition of a tool for a client.
  - Michelle also learned how a third party vendor would be writing their software and how it would integrate with her company's application when the vendor used *WebEx*'s demonstration capabilities to show her and the client a prototype of the software.
  - Michelle uses teleconferencing and the telephone to gather customer requirements.
- Having a good relationship with customers or co-workers is important to work, but having face-to-face contact isn't necessary to develop a good, trusting relationship.
- Because workers receive so many emails on a daily basis and client emails take priority over internal emails, it is sometimes necessary to pick up the phone.
- Virtual workers, especially those working from home, have to stay focused on their work in order to succeed. They must set goals/limits for working.
- Virtual workers should try to go into the office at least a couple of times a year.
- Michelle is very satisfied with the organizational support she receives from her company. She has all the technology she needs to perform.
- She recommends enhancing *WebEx* with pictures of team members or videoconferencing, but, other than that, she is very satisfied with her technological system.
- Virtual work is best-suited for those who have a good deal of experience in their field.
- Because of the high-speed nature of her field, capturing and sharing lessons learned is not a common practice.

Rebecca
- Rebecca has good relationships with members of her virtual team. She got to know most of them in a face-to-face context before she became a virtual worker.
- Instances of informal learning:
  - She has had a number of positive experiences with instant messaging including episodes of coaching, mentoring, and knowledge sharing, especially in the context of producing a radio show.
  - Editing documents can be easily facilitated via technology especially when it is done with a fellow team member with whom a good relationship and usual method of working are established. Rebecca describes a synergy that exists between a fellow co-worker and herself. They exchange documents with changes tracked through email then discuss those changes via telephone.
  - Rebecca also mentors and coaches other chapters in the state about media relations. She also uploads helpful information to the "chapter's only" section of the organization's website.

- Rebecca admits that email can tricky. It lacks the ability to communicate tone and sometimes leaves room for interpretation, especially when time lags between sending an email and receiving a response occur. Rebecca relays an instance where reasons for editing a sentence in a certain way could have been conveyed more easily in a face-to-face meeting has opposed to over email.
- Other technology she uses on a daily basis includes the telephone and tracked changes in Word.
- Rebecca also edits the writings of experts and compiles them in a clearinghouse of information on various topics that is open to the public.
- She enjoys working virtually and is very productive, although others in the organization seem to think she could create more media connections if she were located closer to the chapter.
- In creating an ebook inspired by her attendance at a conference, Rebecca collaborates with experts. She recruits authors using email and telephone.
- In improving technology, she recommends perfecting email so that they are tracked and the sender can know when/if the email was received or read.
- Organizational support could be improved by including her in regular meetings, collaborations, or informal events.
- Virtual work is best suited for certain people and certain jobs. Writers are especially well-suited for virtual work because it is a solitary practice that requires flexibility.
- Rebecca is grateful for technology because she couldn't do her job without it. She looks forward to technology becoming more seamless and reliable.

Andrew
- Virtual workers can be extremely productive if they are self-motivated and if incentives have been set forth for them by their organization.
- As a manager of a virtual team, communication with virtual team members is critical to success. Expectations and routines for communicating and accomplishing work must be established at project kick-off meetings and maintained throughout the life of the project.
- Various technologies enable Andrew to hold virtual meetings where project-related information and performance expectations are shared. He also uses these technologies to establish rapport with team members and edit documents.
- Good relationships with team members are an important factor in virtual work. Good relationships are built on trust and trust is earned through integrity (following through with your commitments).
- Having humor in the workplace is important, but must be used with caution. A good relationship must exist and it shouldn't be used with certain modes of communication such as email.
- Guidelines for the use of technologies, such as email, should be established by the virtual team manager.
- Instances of informal learning include:

- o The global dissemination of strategic and annual plans using a webcast and instant messaging. Webcasts are advantageous because they allow the audience to see body language and other visual cues.
  - o The definition and resolution of a customer issue using teleconferencing. Solutions are then documented in a knowledge database called *SharePoint*.
  - o The reporting of project status and project file sharing using *SharePoint*.
  - o Technology debriefings allow workers to keep up with the high-paced IT world.
- Work orders can be delivered and closed out by field engineering using PDAs.
- Andrew has a positive outlook on technology and believes IT departments should be integrated at the senior management level. He said, "That's why the world of technology is becoming the enabling tool for market penetration as well as profitability." He also believes organizations must keep their finger on the pulse of what's going on so that they can improve.

Kijana
- *NetMeeting* and similar synchronous tools are impractical considering the location of virtual team members who are nationally and internationally dispersed.
- Kijana thinks good relationships between virtual team members are built gradually and facilitated by positive coaching and informal communication.
- In communicating through technology, visual cues are often sacrificed and the ability to gauge a person's personality and style of communication is inhibited.
- There are levels of trust predicated on the nature of the relationship. Family members, for instance, have a greater degree of trust with one another than do co-workers. As a result, conversations with family members can be to the point, whereas conversations with virtual team members may require you to couch your words so that they are conditional and encourage others to offer opinions and ideas. For example, it "might be necessary" instead of it "is necessary" and "I am wondering...what do you think? Other members of her team build trust by beginning every email message with some personal comment or story.
- Kijana is a text-based kind of person, so she doesn't feel it is necessary for her to know what a person looks like. It is possible for her to have a good relationship with someone without ever having seen their picture or having seen them in person.
- Instances of informal learning:
  - o Issue creation using email and the telephone. The telephone gave her a sense of a co-editor's passion for a topic whereas her initial email did not.
  - o Knowledge sharing using instant messaging and the telephone. IM is especially appropriate when you need to exchange really short ideas with someone whom you have an established relationship and high level of trust. For more complex idea sharing, the telephone is more appropriate.
  - o The listserv and threaded discussions are rich sources of informal learning where ideas can be shared and embellished or critiqued by others. Postings to the threaded discussion are typically more carefully thought through and complete than those posted to the listserv. The listserv can be a source

of misconception and accidental postings actually meant for the owner of the listserv and not for the entire listserv.

- o Document editing in Word is also a rich source of informal learning. As changes are made to manuscripts by a number of people and tracked, they become virtual conversations. Team members' view others' comments and changes then contribute their own.
- Email is a helpful tool that promotes reflection that may not be possible in a face-to-face situation or when using the telephone. Because it's asynchronous, email allows you to respond on your own time. This is helpful in emotional situations where reflection time is needed to generate an appropriate, measured response to an unsettling email.
- Tools like *NetMeeting* or *Illuminate* are appropriate when an expert is presenting to an audience but not if would [unclear] like each team member to contribute during the meeting.
- Blogs or wikis could be great tools for collaboration. For example, team members could post to a frequently asked questions (FAQ) page of a blog or a wiki could be developed with the group's collective wisdom on best-practices for a process, such as how the manuscript submission and peer editing work best.
- Kijana offered the following advice to virtual workers:
  - o Make sure your email messages are clearly written.
  - o If you get an email or telephone message you can't address immediately, let the person know that you will do so as soon as possible.
  - o Tools cannot make a good relationship or fix a bad one. What you build depends on your style of leadership, your belief in the way people should work together, the group members' understanding of their roles, the norms that evolve within the group and rules that are created by them.

David
- David enjoys working virtually because of the flexibility that it affords. He saves time that normally would have been spent getting dressed for work and commuting to the office. He feels that he is actually more productive as a virtual worker because there are fewer distractions than those that would be experienced in a face-to-face environment, but he also acknowledges that those face-to-face distractions often lead to talk about work which can be helpful and result in informal learning.
- David uses instant messaging, email, and the telephone on a daily basis to accomplish work goals, but mostly relies on instant messaging. He enjoys the "instant" nature of the technology and feels that it most replicates being in the office and rolling your chair across the aisle to ask a question. It also allows for briefer conversation than calling someone on the telephone. If a coworker is "marked" as busy or out of the office and he has an urgent matter, he'll call them. If there is an issue that doesn't require an immediate response, David will use email.
- He also uses *NetMeeting*'s desktop sharing capabilities on a weekly basis when having a visual aid is necessary to understanding an issue or troubleshooting.
- Instances of informal learning:

- o Visual cues are important in communicating humor using technology. It's important to have some initial face-to-face contact to develop a sense of your team members' personalities. Without that, humor or sarcasm in written communication or on the telephone may be misconstrued.
- o When working virtually, be patient with others' abilities. Since written communication is so important in a virtual work environment, it's important that everyone has clear, accurate writing skills. When that is not the case, patience is required.
- o David participated in an informal mentoring relationship that was carried out primarily by using *NetMeeting* and instant messaging. David and his colleague collaborated on developing programming language.
- o Leaders deliver strategic plans via a teleconferencing tool called Meeting Place. One frustration that David has with these meetings is that presenters forget that remote employees are listening and walk away from the microphone that transmits to the teleconferencing system. This can be very frustrating as sound fades in and out or feedback is experienced. Occasionally leaders use video conferencing.
- o Employees use threaded discussion boards to discuss software issues and engage in design discussions.
- David's organization has a top-down culture where leaders dictate what types of technology employees use to accomplish their work. He wishes this were different and that employees had more say as to what technologies they use on a daily basis.
- In improving technology, David would like to have the ability to use emoticons in written communication to convey mood with text. He would also like to have an integrated system that includes features like instant messaging (with the ability to see the person's "status"), desktop sharing, email, and emoticons.
- David stresses that virtual work requires discipline to be productive and stay focused during the workday and to know when to stop when the day has ended. He also resents the perception by others that home-based virtual workers are lounging around the house and not being as productive as they would be if they were in an office. The flexibility that virtual work affords him actually makes him extremely productive.

Michael

- Michael uses email on a daily basis and enjoys its asynchronicity. Blackberry devices are commonly used to send and receive email when workers are away from the office, but the reading capabilities of such handheld devices limits the kind/quality of the message being sent.
- He also uses *NetMeeting* but mostly with virtual workers/clients located in the US due to differences in time zones. *NetMeeting* is especially useful for document sharing.
- Virtual workers in his company also use Jabber, an instant messaging tool.
- Good relationships with coworkers are important whether you're virtual or co-located, but the quality of the relationship is limited when you interact from a distance. A virtual relationship with little face-to-face interaction may result in misconceptions in communication, in appearance, and in personality. Finally

meeting the person face-to-face may change your impression of them for good or for bad.

- Instances of informal learning:
  - o Rich discussion and collaboration during virtual meetings requires that everyone is on "even footing" using the same type of technology and that someone is driving the meeting. Face-to-face meetings are ideal because visual cues can be exchanged and equal participation in discussions is more likely. When meeting virtually, workers are distracted by their email, the internet, etc…Video conferencing could be useful in simulating face-to-face dynamics but the technology is not ready and its expense is prohibitive.
  - o The need of a defined leader driving the discussion and of somebody taking the action item, is much more needed in virtual meetings, because virtual meeting have a higher probability of misunderstandings.
  - o Webcasts are sources of informal learning. Michael has participated in webcasts where hundreds of people watch him speak and are able to send questions through a chat feature to a moderator who then filters approved questions to him or other speakers.
  - o Some virtual presentations/meetings, such as monthly calendar updates, are taped and archived for future viewing, but Michael warns that there is too much information and too little means of understanding the enormous amount of information it generates. He rarely views the archived meetings.
  - o Employees upload documents to LogicShare, a shared directory, and are able to specify their accessibility to certain people/teams.
- With so many new technologies, it would be helpful if someone within the organization could research those technologies and investigate the needs of virtual workers to make sure there is a match between what virtual workers need and what technologies they are provided.
- While technology is helpful, it also creates confusion and more work. Michael warns, "Use the computer as a tool and don't let the computer use yourself as a tool for creating just more useless information." Technology should be used a tool to aid you in accomplishing goals. It should not overwhelm your life.
- Technology evolves much faster than human attitude and culture and this represent a challenge by itself. The tool can't be any better than the people using it, so a strong focus on the "information age culture" and the way to use it is key in having a success story.

Victoria
- Informal learning as a virtual worker is possible but not as easy. Virtual workers miss out on the opportunity to walk into a coworker's office and ask a question or have an informal discussion about work.
- Building relationships on a face-to-face basis is very important. Virtual work should be blended—partly face-to-face, party virtual. Having a face-to-face kick off meeting is ideal because it helps build bonds with virtual team members and it allows the project leader to set goals and expectations for communication. Face-

to-face meetings may prove more costly than meeting virtual but their return on investment is immeasurable.

- NotesBuddy is an integrated system that has text and voice chat, document sharing, and the ability to view the status of other team members.
- *Sametime*/*Centra* are useful tools in conducting live meetings.
- In preparing for virtual meetings, Victoria accesses the biographies of the people who will be attending using the Blue Pages. It is a searchable "people" database that provides information such as a person's division, their manager, the people they manage, and their picture. This helps her customize the meeting agenda so that the meeting not only fulfills intended outcomes but also fulfills the needs of the participants.
- Trust and credibility (delivering on your commitments) are the most important ingredients to building positive relationships with virtual clients and coworkers.
- Informal learning instances:
    o Live and archived consulting forums via teleconference provide consultants with an opportunity to share their experiences and knowledge. These meetings are announced via email, and, if accepted by the consultant, are added to their calendar. A link to the archived replay is provided in the announcement email.
    o Live and archived all hands meetings with company leaders. Participants may ask questions. Those who are unable to attend can listen to the replay and learn from the presentation and the questions posed to the leaders.
    o Knowledge connections are cross department meetings held on topics important to consultants.
    o Self-study is also a source of informal learning.
- Victoria believes her company is outstanding in supporting her work and the work of all its virtual employees. The company provides workers with the technological support they need while keeping a watchful eye on reducing costs.

Eric
- Eric enjoys virtual work when it is buttressed by informally or formally established guidelines and criteria for communicating. Helpful guidelines specify what types of tools employees will use to accomplish work goals.
- Eric uses the telephone, instant messaging, and *NetMeeting* to collaborate with his team members. Video conferencing is not provided, but Eric does not see it as essential.
- Work task and degree of urgency usually determine which technological tool is used. Quick and simple knowledge sharing is accomplished via instant messaging, email, or the telephone, and, of those three tools, instant messaging is used for issues requiring immediate attention. *NetMeeting* is more appropriate for formal exchanges where document sharing and audio are necessary.
- Eric prefers email when reflection is required.
- Trust is important in developing positive relationships with virtual team members, and trust is built through establishing common ground. Trust can be accomplished from a distance by getting to know personal details about your virtual team mates.

When trust exists, you're less likely to experience miscommunication of tone in text-based interactions.

- Instances of informal learning:
    - Eric has had informal and formal mentoring relationships with virtual coworkers facilitated by various technologies, especially the telephone.
    - Knowledge sharing and management is common within Eric's current and previous organization. Information is housed on the company's shared drive. Access to documents is customizable.
    - Eric admits that face-to-face informal discussions are a rich source of informal learning, but expresses that technology is facilitating a gradual shift in people's dependency on face-to-face contact. Eventually informal discussions that lead to informal learning will be more commonly mediated by technology.
- Having web cams to convey visual cues such as facial expressions is a way to improve technology.
- Eric believes that there is much to be learned and accomplished from virtual relationships, so employees should not be hesitant to let technology assist them in expanding their relationships and experiences with geographically dispersed coworkers.

Gigi

- In her previous position, Gigi maintained team web sites for two virtual teams: an executive team and an advisory council. She would upload documents, such as meeting agendas and notes, to the web sites. This technologically facilitated knowledge sharing and management would keep all team members current on the status of the project, although she seriously doubts that team members accessed these documents between team meetings. The executive team also communicated and collaborated by editing and exchanging documents using email and Word documents with changes tracked.
- To facilitate the work of the international student exchange, Gigi and her globally-dispersed team members use a number of technologies. Instant messaging is commonly used even when a team member may be physically located directly across the hall. IM facilitates short, simple knowledge sharing that may be unnecessarily time consuming if other technologies are used. Team members also have web cams but don't use them often. During the planning phase of the project, video conferencing was heavily used and their collaboration was significantly improved because of it, but scheduling the virtual meetings was difficult.
- Gigi is a self-confessed multi-tasker who is constantly using email and IM. She also uses voice chat which allows team mates to hear one another's voice via the internet.
- Gigi believes collaboration is fueled by investment. That investment can be financial or emotional in nature, although emotional investment is much stronger. Trust in virtual relationships is important but investment is a stronger concept. Investment is built by "water cooler experience" also known as face-to-face bonding. Investment may occur when workers are virtual, but it is a band aid and

will never be as strong as investment built through shared face-to-face experiences.

- Face-to-face contact is important. Without it, your image or impression of your fellow virtual worker will not remain three dimensional.
- The nature of the person is an important factor to collaboration. Collaborators must be willing to share "local knowledge". That is, they should share what is happening at their respective organizations as it impacts the success of the project. They must also be willing to put aside their egos and be able to share failures, successes, and lessons learned with team members.
- In Gigi's work with creating an annual education-related publication, she recruits authors and prepares their work for publication by using email, tracked changes in Word, and the telephone. Her experiences in this position have led her to discover that virtual networking isn't as powerful as face-to-face networking. She cites how going to a conference to recruit authors for her publication was more fruitful than sending out emails. She also tells how using the telephone sparked a relationship between herself and a potential author, but how meeting in a virtual space and sending a follow-up email did not result in her landing an article. She says the technology eventually broke down.

John

- Many technologies facilitate the work of virtual team members. Videoconferencing is used 10% of the time. Email is used 60% to 80% of the time. *Groove*, a comprehensive tool that promotes collaboration between virtual team members, is John's tool of choice.
- *Groove*'s features include shared calendars, file sharing, instant messaging, desktop sharing, project management, and document sharing/automatic synchronization. The organization provides this tool to every virtual team member, including contract workers. John's only criticism of the technology is that it should be cross-platform.
- Chat has some use but when clear milestones and regular meetings are set it is not very necessary. It can lead to micro-managing.
- Email is not a very valuable tool. The sheer number of emails in one day is overwhelming and can be such a distraction that it limits productivity. Email is best for short, uncomplicated communication and nothing should ever be written in an email that you wouldn't want the whole world to see. In some instances, email leads to misconceptions when the wrong words are used, such as asking instead of telling or criticizing versus commenting.
- John says, "It's about using the attributes of the media for the intended outcomes." For example, *Groove* is excellent for project management but complex discussions should be held over the phone or using videoconferencing.
- Developing rapport and trust among virtual team members who are experts in their respective fields is extremely important. It gives them the ability to give and receive constructive criticism. That rapport is best initiated through face-to-face contact.
- Instances of informal learning:

- - *Groove* allows everyone to "be on the same page" as they develop mutual knowledge and understanding about the status of the project, assigned tasks, and task progress. *Groove* provides an accountability and visibility that is lost through email alone.
  - *Groove* also allows multiple users to mark up a document in real time which was especially useful in planning the physical layout of a training session.
  - *Groove* is such a complex tool that a lot of trial and error was used to become familiar with its capabilities and to decide which capabilities are most appropriate for which tasks.
  - Experience proves that face-to-face coaching at the beginning of a project is essential to establishing project expectations and building relationships. Increased performance is the end result.
- Virtual workers need to be self-regulated, self-motivated, and able to prioritize and carry out tasks. Virtual workers should also establish frequent intervals of communication with fellow team members.

Rita
- Document sharing and management are vital in the functioning of a law firm.
- Rita's firm employs a number of technologies provided by third party vendors to help its attorney's produce and manage their documents. The firm uses vendors to synchronize trial videos with paper transcripts and upload and catalog electronic discovery documents into searchable databases. Attorneys can search through documents relevant to their case and download them to their handheld devices. Rita feels the technology could be improved if it were integrated into a comprehensive system that would house all of their documents. The cost of such a system is too expensive and would cause the firm to pass that expense on to the client, which it is reluctant to do.
- Other technologies include email and an intranet office portal with a searchable database.
- Instances of informal learning:
  - Virtual co-counselors and attorneys at Rita's firm hold videoconferences where they collaborate. Videoconferencing is also used for teaching members of the firm how to use software applications. Rooms equipped with videoconferencing have Plasma TVs and cameras that detect and automatically turn toward the current speaker in the room.
  - Teleconferencing is common. Once it was used to coach a foreign client through using the firm's repository system.
  - Attorneys use Live Note, an application that allows an attorney to log-on and view a court reporter's notes in real-time, to "watch" what's going on during a trial at another location.
- The firm invests heavily in technology. They hired an information systems specialist with a law degree to choose and manage technologies used at the firm. Rita refers to research studies that show electronic document collection and management significantly reduces the cost per case as compared to paper document collection and management.

- Rita says that because she comes from a computer background, she views technology very positively and says it allows her to multitask and increases her productivity.
- Relationships between virtual workers are important and built through common courtesies like saying please and thank you and a general comfort with working with others through technology.
- The firm is working on establishing a number of technology-related and case-related best practices to be shared across the firm. Each case manager is given a section to write.
- Rita advises those thinking about becoming a virtual worker to develop a clear understanding of the technologies they will work with, so that they can easily solve any problems they may encounter. She also advises them to be courteous to their virtual team mates.

APPENDIX F: SAMPLE OF CODED INTERVIEW TRANSCRIPT

Code	ID	Q#	Turn#	Data	Notes
				I did some designing for him, answered his questions that way. He was a remote employee as well.	
	FJ06	38	90.	*So you guys again used primarily instant messaging and Net Meeting?*	
13110	06	38	91.	We used a lot of Net Meeting, he and I, because we wanted to share some code programming language, actually write the scripts that make computer programs work. We would share that together so we could see the development in programming tool so that we could see what we were talking about. So we used Net Meeting a lot, but a lot of instant messaging and a lot of phone calls.	Also coded as 12150 use of virtual meeting systems
12150	06	38	92.	We used a lot of Net Meeting, he and I, because we wanted to share some code programming language, actually write the scripts that make computer programs work. We would share that together so we could see the development in programming tool so that we could see what we were talking about. So we used Net Meeting a lot, but a lot of instant messaging and a lot of phone calls.	Also coded as 13110 mentoring
	FJ06	39	93.	*Was that mentoring relationship encouraged by your managers? Was it formal, or did you guys just strike it up yourselves?*	
13100	06	39	94.	We struck it up ourselves.	
16300	06	39	95.	None of my remote employee skills have been fostered by management or the company. I never took any classes. They've never been formal about how we do it. Whatever works for us.	
	FJ06	40	96.	*Do you in some cases wish that they would take more of a lead, and maybe give you guys a list of best practices, or check up on you and say, how's the technology working for you, is there anything else that you need? Do you feel like they support you enough?*	
16300	06	40	97.	I feel they support me by trusting me enough not to get involved. When management gets involved they tend to make things overly complicated. I can give you a perfect example. That instant message tool that I told you about that we use, they've been trying to get rid of that tool and	Grass roots technology

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10000 Participant Background
- 10100 education
- 10200 previous work experience
- 10300 previous VT experience
- 10400 current position
  - o 10410 degree of virtuality
  - o 10420 VT composition
  - o 10440 physical work space and equipment

11000 Virtual Work
- 11100 motivation for working virtually
- 11200 perception of virtual work
  - o 11210 time
  - o 11220 productivity
  - o 11230 nature of job
  - o 11240 nature of person
- 11300 perception of VW by others
- 11400 advice to other VW
- 11500 work experience as a factor for success in VW

12000 Collaborative Technologies
- 12100 Use of
  - o 12110 email/listserv
  - o 12120 chat/IM/voicechat
  - o 12130 teleconferencing
  - o 12140 video conferencing/webcast
  - o 12150 virtual meeting/team spaces (integrated systems)
    - ▪ 12151 handheld devices
  - o 12160 discussion boards
    - ▪ 12161 wikis
    - ▪ 12162 blogs
  - o 12170 knowledge repositories/shared drives/intranet/internet
  - o 12180 telephone/VoIP
  - o 12190 desktop sharing
- 12200 Perception of
  - o 12210 email/listserv
  - o 12220 chat/IM/voicechat
  - o 12230 teleconferencing
  - o 12240 video conferencing/webcast
  - o 12250 virtual meeting/team spaces (integrated systems)
    - ▪ 12251 handheld devices
  - o 12260 discussion boards

- ▪ 12261 wikis
- ▪ 12262 blogs
- ○ 12270 knowledge repositories/shared drives/intranet/internet
- ○ 12280 telephone/VoIP
- ○ 12290 desktop sharing

12300 Recommendations for improvement

<u>13000 Informal Learning Instances</u>
- 13100 Collaboration thru technology
  - ○ 13110 mentoring
  - ○ 13120 networking
  - ○ 13130 coaching
  - ○ 13140 knowledge sharing/demo
  - ○ 13150 knowledge management
  - ○ 13160 trial and error
  - ○ 13170 problem solving
  - ○ 13180 document editing
  - ○ 13190 planning
- 13200 Self-directed
  - ○ 13210 writing lessons learned/reflection
  - ○ 13220 use of archived documents

<u>14000 Perceptions of Informal Learning</u>

<u>15000 Relationships with VT Members/Clients</u>
- 15100 importance of trust
- 15200 building trust
- 15300 importance of relationships
- 15400 building relationships
- 15500 setting expectations
- 15600 emotional investment/feelings

<u>16000 Organizational Context</u>
- 16100 culture
- 16200 mission/philosophy
- 16300 support
- 16400 incentives/rewards
- 16500 expectations of the org for VW
- 16600 managing/leading a VT

<u>17000 Visual Cues</u>

APPENDIX H: SAMPLE OF MASTER TABLE FOR CROSS-ANALYSIS

Code	ID	Q#	Turn#	Data	Notes
				conversation, talking with someone and hearing their voice, and then from there through emails and stuff you kind of get a feel…I think the trust is already established through the telephone conversation and then the emails typically you understand where that person is coming from. There's more trust as you said established to prevent from misunderstanding.	
15200	10	28	84.	I will tell you if you never meet face to face you don't ever have a 3 dimensional relationship or image of that person on the other side. Your relationship and your image of that person will remain 2 dimensional.	Also coded as 17000 visual cues
15300	08	13	37.	I'm a relationship person. I manage projects, and I think it's essential. I think it's one of the most important things you can have is client relationships, people management.	
15300	11	11	47.	Then social relationships are still very, very important. So in Groove social relationships are not as important when it's more for archival, quality, consistency of message, you know, historical documents, maintaining project management. When we make decisions we get on that phone or we video conference or we're using Groove as an appendage tool. See the difference?	Technology/task continuum; also coded as 13170 problem solving and 11200 perception of virtual work
15300	11	12	58.	It's very difficult to develop a rapport when we have a team of six people developing a scope document and you have to critique each other, there's a pedagogical expert, the subject matter expert, standard expert, and there are several of each, and they make a sixty page planning document, scope document that talks about what we're going to do, how we're going to measure it, what the outcomes are, stuff like that. Before you actually make the product…it's just good instructional design, if they don't know one another, if they have not worked with each other before which is what the case would be moving forward, they don't feel comfortable enough to speak frankly, professionally, constructive criticism of the other person's work. But that is essential.	*Ego as a barrier to collaboration? Like in Gigi's interview with the professors. Expertise as a barrier to collaboration?* also coded 13160 trial and error
15300	12	17	53.	The other thing that I would probably advise them is that, it's good to	Also coded as 11400