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The effect of interactive technology on informal learning and performance in a social setting

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THE EFFECT OF INTERACTIVE TECHNOLOGY ON INFORMAL LEARNING AND PERFORMANCE IN A SOCIAL SETTING

by

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Approved by:

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Advisor Date

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DEDICATION

I have drawn upon the generosity of my family and friends, at times selfishly and self-serving, for the inspiration and encouragement required to achieve this major milestone in my life. By way of family, I dedicate this completed work in its entirety to my wife Josephine who has been my constant partner, my soul mate, my muse, my unflinching ally in the face of adversity, and always at my side during this odyssey that has spanned nearly a decade of our life together. I also dedicate this work to my sons, Brandon and Marcus, in hopes that it may inspire them to reach higher in achieving their own dreams, no matter how difficult it may seem at times.

I also dedicate this work to my former boss, colleague, fellow researcher, and friend, Ben Leonard. For the past four years, Ben has at times provided cover, encouragement, and conviction for this study. I am grateful for the many hours we engaged one another in purely academic discourse related to our research agendas and application of results, and for the thoughtful guidance and insight that Ben provided to my research design and analyses strategies.

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Chapter 1

Introduction

In the span of less than a single generation, knowledge workers have gained unprecedented access to continuous informal learning opportunities through interactive technology. Examples of interactive technology include performance support tools, electronic performance support systems, Web-based training, games and simulations, and search engines such as Google®, Yahoo® and Bing®. Web 2.0 has created opportunities for social networks of collaboration comprised of blogs, wikis, on-line forums and social network platforms for constructing social learning communities within larger communities of practice. Knowledge workers are also adopting a myriad of hardware-driven interactive technologies in the mobile computing domain. This includes smartphones such as Blackberry® and iPhone®, as well as the iPad® tablet mobile computing device. All of these devices are predicated on the use of 'apps' (applications) that have been optimized for the device and the network they are deployed on, in addition to the Web-based technologies cited above which are also being accessed from these devices.

Informal learning refers to activities initiated by people in work settings that result in the development of their professional knowledge and skills (Cofer, 2000; Lohman, 2000). Traditional and corporate learning institutions; professional organizations; social and peer-to-peer learning networks are now creating new opportunities for informal learning. Unlike formal learning, informal learning can be either planned or unplanned and structured or unstructured. Examples of informal learning activities include talking and

sharing resources with others, conducting a Web search, and experimenting with new techniques and tools (Lohman, 2006). Formal learning is generally characterized by a separation between the learning event, and the application of the knowledge or skill in some type of performance. In contrast, informal learning is more often situated in meaningful experiences, and builds upon tacit knowledge that may have been gained through formal learning events.

Organizational expectations for conversion of learning to performance on the job have changed. Organizations are concerned with meager results produced from classroom training. Corresponding changes have occurred in individual workers' expectations for conditions under which informal learning takes place. According to Cross (2007), the focus has shifted from training to talent management in many organizations, by putting on-line development programs into place. In this new paradigm, employees work with their managers on a one-to-one basis to determine what competencies they must master. Then they agree on a path to get there: on-the-job learning, mentoring, coaching, books, conferences, and other means. Although some formal training still exists (compliance and certification training for example), informal learning is an organic, self-initiated process connecting learners to one another, to information flows and work, and to their teams and organizations. The environment in which informal learning takes place is often the same one in which the work is performed. Measurement of performance is correspondingly tied to the setting and a transfer of activities to achieve a predetermined goal (Kuutti, 1996).

This research study examines the relationship between informal learning activities and their effect on on-the-job performance, mediated by a set of technology-driven behavioral factors related to the environment and the worker.

The study of the effects of technology on learning and performance is complicated, however, by a set of confounding factors that include: social context, politics, cultural attitudes, aptitude and motivation of the worker, the proliferation of information needed to perform one's job, the pressures of a global economy, and the new role of a knowledge worker.

Statement of the Problem

Interactive technology has become ubiquitous, permeating all aspects of society. Research shows that technology tools have a mediating effect on informal learning activities and performance outcomes. However, there is inconsistency in the way that interactive technology is perceived and used by knowledge workers within the same organizational culture, tasked with the same activities that are linked to predefined performance outcomes. A systemic view to provide insight into this phenomenon is missing.

Purpose and Research Questions

The purpose of this research study was to explore a sample of knowledge workers' perceptions and behaviors related to interactive technology as a mediator for informal learning and performance activities in a single organizational setting. It was anticipated that better understanding of the mediating relationship between technology and setting, would provide a more systemic view of the effect of interactive technology on informal learning and performance, for individuals and groups in today's modern workplace. The set of research questions intended to shed light on the problem are:

Q1. What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?

Q2. What are the rules for the use of interactive technology for peer-to-peer and group collaboration?

Q3. How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?

Q4. How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?

Q5. How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?

Theoretical Constructs

There are two theoretical constructs and a performance improvement model that I considered central to this study. They are: Distributed Cognition, Activity Theory, and the Behavior Engineering Model. Each of these constructs is instrumental in transitioning from studying individual learning and performance in relative isolation, to studying the larger systems affecting informal learning and on-the-job performance in relation to the environment. These constructs are discussed in the remainder of this section.

Distributed Cognition

Distributed cognition has its roots in anthropology, and refers to the study and understanding of the interaction between humans, artifacts, machines and the environment to produce a performance-based outcome. In essence, distributed cognition suggests that human knowledge and cognition are not confined to the individual. Rather, cognition is distributed by placing

experiences, memories, facts, or knowledge of objects, individuals, and tools into the environment as artifacts that are mediated by technology. Reification is achieved through social-cultural integration, thus providing context. One of the main goals of distributed cognition is to explain how the structures that make up a functional system (individuals and artifacts) are coordinated, and how they interact (Decortis, Noirfalise, and Saudelli, 2000). The relevance of distributed cognition to this study is twofold. First, it is necessary to understand the mediating effect of technology-based tools and artifacts on performance transfer in the work environment. Second, informal learning activities extend beyond the individual to include the context within which the learner operates, producing tacit and explicit knowledge. Cognitive processes affecting informal learning may be distributed socially, across groups of people, or may be mediated by artifacts and tools (Gilbert, 1999). This study takes a systemic view of performance, considering interactive technology as a cognitive tool that is integrated within an environment in which knowledge is gained through informal learning activities and used to produce performance-based outcomes. The cognitive properties of the system can thus be described separately from the processes that are limited by an individual's cognitive capacity (Decortis, Noirfalise, and Saudelli, 2000).

Activity Theory

The second theoretical construct central to this study is Activity Theory. Activity Theory is a development of socio-cultural theory, which states that relations between individuals and artifacts are not symmetrical; artifacts may be mediators of human thought and behavior, but human motive and consciousness belong to people, not things (Kaptelinin, 1996). The psychological framework for

activity theory can be traced to the work of Leont'ev, who extended the work of Vygotsky (Leont'ev, 1978). The relevance of activity theory to this study draws from its relationship to human-computer interaction (HCI) and information systems research (Kuutti, 1991). Kuutti (1996) summarizes research concluding that HCI within the information-processing branch of cognitive psychology lags far behind practice. This creates a situation where researchers study successful HCI solutions post-implementation through observation, to understand why they work. Guidelines are qualitatively derived using empirical data with no underlying theory. Activity theory helps to bridge the gap between practice and theory, by providing a framework to study the effect of technology tools on performance in complex social settings.

Leontiev (1974) distinguishes three levels of human activity: activity, action, and operation. Simply stated, activities are made up of actions, which are comprised of operations. Kuutti (1996) presents the three levels in a hierarchical view of activity theory showing action [behavior] as the central level in the breakdown of activity. Each action is oriented towards a goal. Each goal is functionally subordinated to other goals, and the top-level goal is the object of the activity. Moving down the hierarchy, behaviors leading to achievement of goals are dependent on environmental conditions, which in turn affect the operations. Thus, activities are made up of actions or chains of actions, which are in turn made up of operations. This relationship is shown graphically in Figure 1.

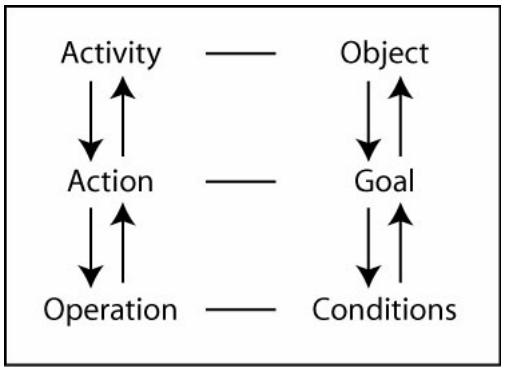


Figure 1. Levels of activity. (adapted from Kuutti, 1996).

In the context of this study interactive technology is employed at the operation level by mediating the conditions in which operations are carried out. Environmental and personal characteristics affecting behavior are integrated with performance goals at the action level. Informal learning activities are enabled at the activity level. The object of the activity is measureable on-the-job performance.

Engeström (1987) provides a systems view of activity theory based upon mediation between the various components that make up the activity system. Referring to Figure 2, the activity (i.e., the informal learning activities) of the worker towards the object (i.e., on-the-job performance) is mediated by the tools to affect individual on-the-job performance. This means that the tools shape the way the activity is performed, and are themselves modified through the activity. In a similar fashion, rules (linked to social/environmental context) mediate the relationship between the worker and the community, and are modified by these interactions. Finally, the division of labor (personal characteristics) mediates access to informal learning activities available to the community to produce an organizational level performance outcome (i.e., on-the-job performance). In summary, the key mediating effects of this model are tools, rules, and division of

labor, as highlighted in Figure 2. Additional inferences may be drawn, as shown by the dashed lines in the model. The interactive technologies, in terms of available tools and information, determine to a certain extent the level of collaboration that may occur, and the amount of business intelligence available to the community. The rules provide structure, aligned with the business culture and social setting, affecting the manner in which activities are carried out. The division of labor affects the way roles are perceived and carried out by the worker. It is not uncommon for a knowledge worker to assume multiple roles in the course of completing an activity.

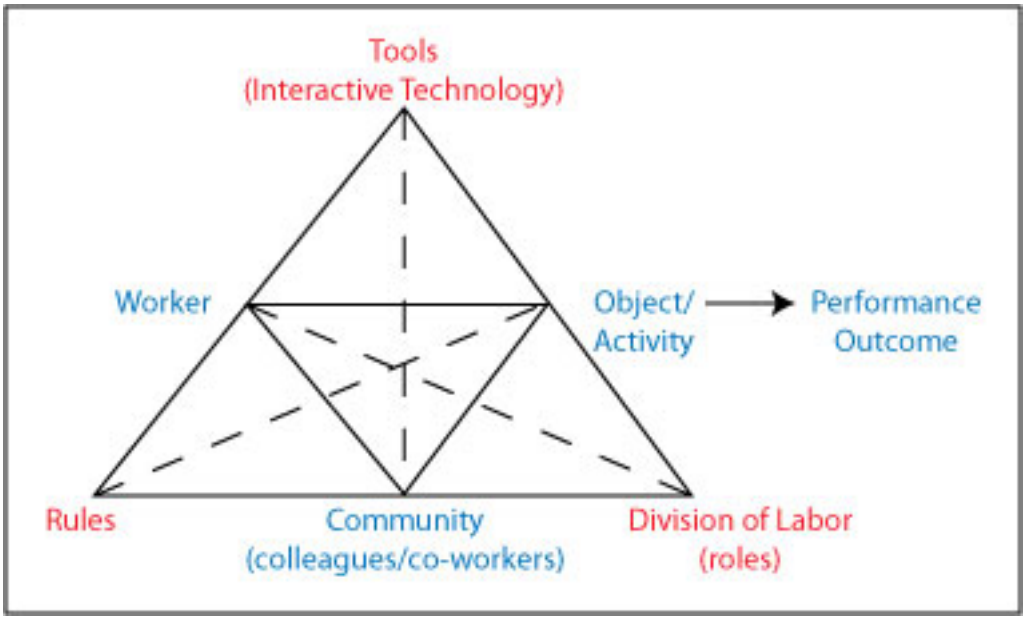


Figure 2. Systems view of activity (adapted from Engeström, 1987).

The primary benefit gained in applying Engeström's (1987) activity theory model in the context of this study is the ability to relate individual and organizational (informal learning) activities to a performance-based outcome. A secondary benefit of the activity theory model is that it allows for environmental and personal characteristics to be represented systemically within a highly visual

theoretical framework. The components of the system organically influence and transform one another in response to individual and environmental changes affecting performance. In this way, the context for the activity and the object is tied to the system, which is defined by its constituent components. At the same time, each system under consideration may be thought of as a node (or subsystem) in a network of interrelated activity systems spanning the enterprise.

Conceptually, distributed cognition and activity theory are closely related and the two share many of the same perspectives (Gilbert, 1999). Considered together, distributed cognition and activity theory provide a theoretical framework to extend the range of cognition by including the individual's interactions with tools and the environment. Activity theory is not a predictive theory. Rather, it is a conceptual framework within which different theoretical perspectives may be employed for observation and analysis.

Behavior Engineering Model

The third construct is the Behavior Engineering Model (BEM). Gilbert's (1996) BEM provides a framework for considering the effect of environmental and personal factors on activity tied to informal learning and performance. Gilbert's BEM suggests that six factors affecting performance are divided between the environment and personal domains. The factors are: data, resources, incentives, motives, capacity, and knowledge. They are grouped as information, instrumentation, and motivation as shown in Figure 3.

	Information	*Instrumentation*	*Motivation*
Environmental Factors	Data 1. Relevant and frequent feedback about the adequacy of performance 2. Descriptions of what is expected of performance 3. Clear and relevant guides to adequate performance	Resources 1. Tools and materials scientifically designed to match human factors	Incentives 1. Adequate financial incentives made contingent upon performance 2. Nonmonetary incentives made available 3. Career-development opportunities
Personal Factors	Knowledge 1. Scientifically designed training that matches the requirements of exemplary performance 2. Placement	Capacity 1. Flexible scheduling of performance to match peak capacity 2. Cognitive ability 3. Emotional ability 4. Selection	Motives 1. Assessment of people's motives to work 2. Recruitment of people to match the realities of the situation

Figure 3. Behavior Engineering Model (Adapted from Gilbert, 1996, p. 88).

According to Gilbert (1996), the BEM provides alternative views of a single observable performance phenomenon called behavior. Gilbert suggests that worthy performance cannot exist unless all six factors affecting behavior are present. An original intent of the BEM was to serve as a diagnostic tool for troubleshooting sub-standard performance.

In the context of this study, the six factors (data, resources, incentives, motives, capacity, and knowledge) divided between the two domains (environmental and personal) in the BEM taxonomy represent a set of antecedent variables affecting (informal learning) activity in a performance system. A limitation of the BEM in this study is that it does not account for intervening variables related to the social and cultural context of the environmental and personal domains, which ultimately affect performance. This context is provided by the set of mediated relationships identified in Engeström's (1987) activity theory model, as previously discussed in this section. The result is that the Behavior Engineering Model provided by Gilbert (1996) and the activity theory

model provided by Engeström (1987) complement one another in the development of the research framework that was developed for this study.

Assumptions

Based on my experience and background as a knowledge worker in the research setting, there were four assumptions made about knowledge workers who participated in this study. The first assumption was that knowledge workers are exposed to and independently adopt interactive technology tools within and outside of the work setting, which influence behaviors and actions. The second assumption was that knowledge workers are engaged in communities of practice, which may or may not receive formal support from their employer. The third assumption was that knowledge workers create personal informal learning networks to support their performance and ongoing learning. The fourth and final assumption was that considerable variance exists among knowledge workers in terms of comfort level with change, adoption of new practices, and motivation to embrace new interactive technologies.

Rationale and Significance

The rationale for this research study emanates from my desire to better understand the relationship between interactive technology and human activity in the context of informal learning and human performance. Everyday, there are new reports on virtualization of learning and performance via the social Web. Indeed, within the global communities of practice enabled by Twitter, Yammer, and others, these reports occur hourly. What appears to be missing is a systemic framework based on human activity and distributed cognition that can be used to rationalize new technologies in a situated social and cultural context. As discussed in the theoretical constructs section, the current practice in evaluation

of successful human computer interactive solutions is to study the effects post-implementation to understand why they work. While it was not suggested that a predictive model would emerge from this research study, a desired outcome achieved was a conceptual framework providing support for complementary theoretical perspectives in the collection and analysis of empirical data related to the problem being researched.

The significance of this research study is that it may contribute to the domain of human performance technology by providing a new lens to view the mediating effect of interactive technology on informal learning and performance within an activity-based system. The principal potential benefit is to add to the body of literature for activity theory by demonstrating its relevance as a conceptual framework for affecting learning and performance in modern organizations. A practical application for the study is to provide intra-organizational insight, for the study participants and company, into social and cultural best practices, and policy recommendations for the application of interactive technology.

Definitions of Key Terminology used in the Study

Knowledge Worker

Drucker first coined the term "knowledge worker" in 1959 as a person who gets paid for applying what they learned in school, rather than for their physical strength or manual skill (Drucker, 1996). For the purposes of this study, a knowledge worker is considered anyone who works for a living at the tasks of developing or using knowledge. This categorization traditionally includes professionals such as teachers, lawyers, architects, physicians, nurses, engineers and scientists.

Activities performed by knowledge workers may include planning, acquiring, searching, analyzing, organizing, storing, presenting, distributing, or marketing associated with the production of an object. With increased dependence on information technology across all types of organizations, the number of fields in which knowledge workers are now expected to perform has increased dramatically.

Informal Learning

Informal learning refers to activities initiated by people in work settings that result in the development of their professional knowledge and skills (Cofer, 2000; Lohman, 2000). Examples of informal learning activities include talking and sharing resources with others, conducting a Web search, and experimenting with new techniques and tools (Lohman, 2006).

Cross (2007) described informal learning as occurring whenever learners set their own learning objectives. Humans learn when they perceive a need to know, and evidence of learning is in their ability to do something they could not do before.

Interactive Technology

For the purposes of this study, interactive technology refers to all forms of digital technology emphasizing innovation and human- or user-centered approaches. Interactive technology may be hardware, software, or Web-enabled. Examples of hardware include: desktop, laptop, or handheld computers; and mobile devices as such as Blackberry® and iPhone® smartphones, and the iPad® tablet computer. Examples of software include databases, specialized applications (e.g., word processing, spreadsheets, Web browsers, email, chat,

etc.), electronic performance support systems, Web-based training, games and simulations, and search engines such as Google® and Bing®.

Summary

This study was intended to address the research problem presented, which was: 1) provide insight into why some knowledge workers make more effective use of interactive technology, for informal learning and performance, than do others within the same organizational setting; and 2) apply a systems view of activity theory to understand the mediating effect of technology and setting on informal learning and performance in a modern workplace environment. A theoretical foundation for the study was developed, drawing from distributed cognition, activity theory, and the Behavior Engineering Model. A set of research questions emerged, based on the existing body of literature related to activity theory, which provided guidance for the research study design. Key definitions of terminology used in the context of this study are noted. An appropriate review of the literature follows in the literature review chapter of this dissertation.

Chapter 2

Literature Review

The purpose of this qualitative research study was to explore a sample of knowledge workers' perceptions and behaviors related to interactive technology as a mediator for informal learning and performance activities in a single organizational setting. The principal theoretical framework used in the design of this research study is the activity theory model presented by Engeström (1987), which I summarized in Chapter 1. For this reason, a review of the relevant theoretical literature for activity theory was considered central to this literature review. A conceptual framework based on the research questions addressed in this study, also guided this literature review.

This literature review is organized in five parts. The first section covers the classification scheme for the study participant sample by discussing the characteristics of a knowledge worker. The second section provides context for interactive technology as a mediator of activity. The third section provides a review of the theoretical research that will serve as the basis for the design of the research study, which is covered in the methodology chapter. The fourth section reviews relevant empirical research related to this research study. The fifth and final section provides conclusions and implications of the literature for further research specifically related to this study.

The Knowledge Worker

Drucker first coined the term "knowledge worker" in 1959 as a person who gets paid for applying what they learned in school, rather than for their physical strength or manual skill (Drucker, 1996). This suggests a dilemma in determining how knowledge workers learn on a continual basis, in a global

information-driven economy. Cross (2007) suggested that 70% of learning occurs informally, on an ad-hoc basis within organizations, whereas 20% is through on-the-job training, and 10% is through formal learning interventions. Cross (2007) defined learning as the potential for changing performance on the job through the acquisition and transfer of new knowledge. The tools for knowledge development, and informal learning activities engaged in by knowledge workers tend to be situated more closely to the environment in which the work is performed. In this context, the focus is on immediate transfer, to affect improvements or enhancements to performance, as opposed to developing knowledge for knowledge sake (Foxon, 1993).

Performance in the workplace can be generally defined as the achievement of an expected or predetermined outcome. The nature of work and corresponding expectations for individual as well as organizational performance in the workplace are very different for knowledge workers as compared to laborers in manufacturing and service industry jobs. Pink (2005) links this difference to a shift in demand for right-brain creative thinking skills as America moves from the information age to the conceptual age. Performance of knowledge workers involves a relationship between the workers' perceptions of the job and setting, artifacts and tools in the environment, and informal learning activities leading to some new insight affecting on-the-job performance.

Interactive Technology and the Knowledge Worker

The ability and skill level of knowledge workers to effectively use interactive technologies for acquiring information and integrating new knowledge into workplace tasks is of paramount importance in a modern corporate environment. The need to understand the effects of interactive

technology on informal learning for cultivating professional expertise, brings focus to the interplay between the learning activities, the work environment, and the characteristics of the worker that effect performance (Lohman, 2006).

In recent years, there has been considerable discourse on the role of technology and the degree to which it influences learning (Clark, 2001; Kozma, 2001). The conclusion most often drawn is that design and context play a larger role in the effectiveness of the content in its ability to affect learning, than does the media selection itself (Schramm, 1997). This does not suggest, however, that good design automatically leads to greater knowledge transfer and improvements to performance. Rather, the ability of learners to acquire and convert knowledge into performance is also dependent on a set of factors that are external to the learner.

For learner engagement and knowledge transfer to occur, informal learning needs to be: 1) authentic, meaning that the learner should learn in the context of the workplace or other application environment; 2) situated in meaningful experiences in order to build on learners' prior knowledge; and 3) anchored in relevant activities to promote transfer to workplace problem solving (Herrington, Oliver, & Reeves, 2003). Learners need to be engaged in order to focus their attention and cognitive effort on learning. Learner engagement and interaction with the content are essential to learning transfer (Herrington, Oliver, & Reeves, 2003). This lends support for a more learner-centered approach to learning including problem-based learning and case-based learning in which technology is an enabler. Learning and the work enabled by learning have become inseparable for knowledge workers (Cross, 2007).

Technology has also been shown to have a mediating effect on activity through the use of symbols for linguistic communication, and artifacts for externally managed collective knowledge. Rossett and Schafer (2007) view this effect in terms of performance support, specifically as a repository for information, processes, and perspectives that inform and guide planning and action. This approach is less concerned with new knowledge acquisition and more in the direct application of external knowledge using either a sidekick or a planner (Rossett & Schafer, 2007). A sidekick functions as a job aid in the context of some activity. An example of this is a GPS navigation system providing turn-by-turn instructions in the situated context of operating a vehicle. A planner is used in advance of the activity to access prior, externally created knowledge, for use in a specific context. An example of this would be accessing Google® Maps via the Web to determine (i.e., plan) the most efficient route of travel between two pre-determined points, in advance of starting the trip. A distinction is made between performance support and other categories of tools such as flashlights and chairs, and instruction that provides for the acquisition of knowledge and development of performance potential. In the case of tools, there is no innate support for performing the activity; there is only potential support for manipulating the environment to make it more conducive to the activity. Instruction develops performance potential in a context-neutral activity; whereas, performance support is situated in the context of the activity itself, relying on the technology to mediate performance. Performance support is further characterized using four factors: convergence, simplicity, relevance to performance, and personalization (Rossett & Schafer, 2007).

Convergence is rooted in proximity meaning that the information and guidance is situated where the performer and challenge are. Simplicity implies a focus on the content in the here and now to accomplish a task. Relevance ensures support enabling a performer to accomplish his or her goals in a specific context. Personalization adjusts information and guidance according to a set of individualized needs in a specific context. Interactive technology, in the examples previously discussed, allows for personalization of performance support by being able to dynamically adjust the level of information and guidance, according to the needs of the situation. Personalization also enables user-generated content adding new insight and lessons learned, thus increasing the utility of the tool and contributing new artifacts to the collective body of knowledge available to the community in a more interactive user experience.

Interactive technologies have a mediating effect on informal learning using different modalities (e.g., text, images, video or audio) to accommodate a range of individual learner characteristics, preferences and contexts. In general, people learn better from words and images than from words alone; a principal referred to as dual-channel encoding (Mayer, 2005). Knowledge workers must also be motivated to self-initiate informal learning activities through collaborative operations. This may be intrinsic (learner driven) through activities that help guide the learner, and extrinsic (environment driven) to ensure that objectives for learning and performance are achieved (Keller, 2010).

Theoretical Research

Activity Theory

Activity theory and its related constructs provide a powerful descriptive tool rather than a strongly predictive tool of human activity, with nearly a

century of scholarly work associated with its development. Activity theory differs from other psychological theories in that it enables the study of human actions, on a continual basis, in environments outside of the laboratory. This is based upon the premise that actions are always situated in a context, and cannot be fully understood outside of that context. Context is derived from the specific intermediary goal that the action is directed towards (Kuutti, 1996). The implication is that some minimal meaningful understanding of context within which individual actions occur, must be a part of the basic unit of analysis. This unit of analysis is an activity, combining actions and context to achieve a top-level performance goal, referred to as an object. A basic tenet of activity theory is mediation. Indeed, tools and sign systems mediate all human experience. These mediators, in turn, serve to connect us organically and intimately to the world (Nardi, 1996a).

Simply stated, an activity is a form of doing, which is directed towards an object. Activities are distinguished from one another according to objects, which in turn provide motive for the activity (Kuutti, 1996). An object can be a tangible thing, such as an artifact that is produced, or something intangible, such as a common idea, as long as the participants in the activity can share it for manipulation and transformation of the object. The relationship between the participant and the object in the activity is not direct. Rather, it is mediated by a tool, which carries with it the history of the relationship.

Historical perspective of activity theory. The origin of activity theory can be traced to Russian Psychology of the 1920s and 1930s. Discussion will be limited to major contributions by Vygotsky, Basov, and Leontiev.

Vygotsky and Piaget are both credited with advancing psychological constructivist theories that embody transactional, relational, and contextualized modes of thinking about human development (Vianna and Stetsenko, 2006). There were at least three main points of convergence by Vygotsky and Piaget. The first is that interaction between people, objects, and the environment (i.e., culture and society) is at the core of human development. Second, is the assertion that activity occurs in some context, which cannot ignore the socio-cultural and relational dimensions of human development. Lastly, is the view that children (as well as adults) learn through interaction with the environment. Where they diverge in their views, is at the very core of human activity development. Piaget was rooted in biological thought developed after Darwin, which postulates that the essence of human development is in adaptation to the environment. Vygotsky, whose influence was from Marx and Engels, was critical of the environmentally centric view posited by Piaget (Vygotsky, 1978). Vygotsky (1978) held the view that people do not simply adapt to their environment, but instead transform it through interactive collaborative practices. In so doing, they transform themselves by gaining their own personal status and essence, and they transform society through interactive collaborative practices within a social community with other people (Vygotsky, 1999; Stetsenko, 2004). There was also divergence in how Vygotsky and Piaget viewed the way children learn. Piaget believed that children learn and develop by adapting to their environment. Vygotsky believed that children learn as they interactively transform their environment. These conceptual differences have led to broader and more dynamic conceptualizations of learning which are considered in activity theory, including notions of the zone of proximal development, meaning making,

collaborative discourse, and scaffolding—these concepts are mentioned here for historical context only and will not be explored more fully since they are outside the scope of this study.

Kaptelinin and Nardi (2006) argue that the impact of Russian psychologist Mikhail Basov on the development of activity theory is no less important than that of Vygotsky. Basov's theoretical approach, first presented in 1930, was based upon the concept of human beings as "active agents in environments." Basov identified three variables—the human being, the environment, and activity—as being essential to the understanding of human work and development. Basov performed subsequent theoretical and empirical analyses resulting in identification of the structural components of an activity. This work provided further insight into how activity is stimulated by objects in the context in which the activity occurs, by emphasizing the importance of mediating artifacts. A recurrent theme in Basov's work, which has helped shape the systemic view of activity theory, is that environments act as integrated wholes (i.e., systems) and not merely collections of stimuli (Engeström, 1987).

Leontiev, who was a student of Vygotsky, is recognized for building on the foundation for activity theory started by Vygotsky, by developing his own research agenda. Specifically, Leontiev (1981) extended Vygotsky's (1978) description of a mediated relationship between the subject and object, by including social interactions. In doing so, he formulated a notion of human activity in the idea that behind the object stands a need or desire, for which activity provides the answer. Leontiev (1981) identified three levels in an activity system hierarchy, which are affected by individual or community intentions. The top level is an activity, which is conscious and driven by an object-related

motive, such as the production of new knowledge. The middle level is an individual action that is still conscious and driven by a goal, such as capturing ideas into a database. The lowest level is an automatic operation, which is unconscious and driven by the conditions of the actions, such as typing.

Key tenets of activity theory. Kaptelinin and Nardi (2006) suggest four tenets for activity theory, which are encapsulated in the notion of people interacting with technology. The tenets are:

- An emphasis on human intentionality
- The asymmetry of people and things
- The importance of human development
- The idea of culture and society as shaping human activity

Within each of the interactions that occur between people and technology on a daily basis in both their professional and personal lives, people deliberately commit certain acts with certain technologies. "Activity theory distinguishes between people and things, allowing for a discussion of human intentionality" (Kaptelinin & Nardi, 2006, p. 10).

Asymmetry between people and things refers to the disproportionality between subjects and tools in an activity. People act, using technology to construct and instantiate their intentions and desires as objects. Conversely, tools provide mediation between people and the world without any innate intentions of their own.

The notion of human development (i.e., informal learning) in activity theory is a shared commitment with the cultural-historical school of psychology to understanding how human activity evolves over time. Humans have a long

history of using technology to develop and share tools that transform their activity. Activity theory thus places strong emphasis on individual development through informal learning, that is affected by and gains context from the socio-cultural matrix within which individuals develop.

Guiding principles. Within the general framework of activity theory, there are six guiding principles, which are closely interrelated and integrated to describe activity theory as a whole (Kaptelinin, 1996a). The first and most fundamental principle is that of the unity of consciousness and activity. Consciousness refers to the human mind as a whole, while activity represents human interaction with objectified reality. This principle asserts that the human mind is a key component of human interaction with the environment.

The second principle of activity theory is object-orientedness. This principle specifies the approach to the environment in which human beings are interacting. In activity theory, social and cultural properties of the environment are considered to be as objective as physical, chemical, or biological properties.

The third principle of activity theory embodies the hierarchical structure of an activity, first described by Leontiev (1981). Activity theory considers processes at three levels, or groups, along with the objects these processes are oriented towards. At the top level, activities are oriented towards the motive of the object itself, where each motive satisfies a need. At the middle level, actions are subordinate to activities and are oriented toward specific conscious goals. At the bottom level, actions are realized through operations performed at an unconscious level and are oriented towards the specific conditions of the activity.

The fourth principle of activity theory is the concept of internalization-externalization, developed by Vygotsky (1978). This principle describes how

mental processes are derived from external actions through the course of internalization. It is also referred to as the zone of proximal development, which identifies the distance between mental processes tied to external actions performed by an individual, and the historically new form of social activity that can be collectively generated as a solution.

The fifth principle of activity theory is mediation. All human activity is mediated by tools, which can be either external (e.g., a computer, cell phone, hammer, or scissors) or internal (e.g., ideas, concepts, or heuristics). Tools specify their modes of operation, which are rooted in cultural knowledge and social experience. As a result, the use of tools has an influence on the nature of mental development in humans.

The sixth principle of activity theory is the principle of development. "According to activity theory, to understand a phenomenon means to know how it developed into its existing form" (Kaptelinin, 1996a, p. 108). By internalizing the principle of development it is possible to understand complex phenomena through scientific analysis.

Methodological implications. Nardi (1996b, p. 95) provides a set of methodological implications for activity theory that can be applied to human-computer interaction studies. These have been summarized here.

1. A research time frame long enough to understand user's objectives. Activities and their objects may not be immediately transformed into outcome, suggesting that a meaningful study must be able to take into account the related process that may consist of multiple steps or phases. Related to this is the understanding that actions will change with the process, as they become objectified over time.

2. Attention to broad patterns of activity. A macro view of the activity should be developed to take into account the range of episodic actions in order to reveal the motives associated with the activity. An illustration of this is in reviewing different observations in ethnographic fieldwork to analyze the broad patterns of an activity.

3. The use of a varied set of data collection techniques. While this may appear as self-evident, it is important to apply different techniques including interviews, observations, transaction logs, video, and other historical materials in order to analyze the range of complexities involved in different interactions, in varied social and cultural settings affecting the transformation of an object.

4. A commitment to understanding things from users' points of view. Holland and Reeves (1996), and Bellamy (1996) underscore the importance of gaining the human subject point of view in the study of the use of technology within a community of knowledge workers and operating in the same environment.

Cross-disciplinary reach. Activity theory provides a cross-disciplinary framework that can be applied to the study of human practice and development processes by simultaneously interlinking individual and community social levels of interaction, within the context of an activity (Kuutti, 1996). As such, activity theory serves as the umbrella framework to guide the comparison and integration of other theoretical perspectives for this literature review. The activity theory umbrella framework has been extended to a number of research domains which are relevant to this study, including:

- Distributed Cognition

- Computer Supported Collaborative Learning (CSCL)
- Computer Supported Collaborative Work (CSCW)
- Human-Computer Interaction (HCI)

Each of these theoretical domains will be discussed briefly in the remainder of this theoretical research section.

Distributed Cognition

In general, cognitive science is concerned with information, its representation, and propagation. In distributed cognition, this involves creating, storing, and retrieving information schema to extend individual cognitive abilities. Conversely, activity theory is concerned with practice (i.e., *doing*) and activity, requiring mastery of mediating tools within the context of a performance activity (Zinchenko, 1986).

Hutchins (1995) defines distributed cognition as cognitive processes and artifacts distributed between people and tools where both are equivalent "media" in a system. This would appear to place people and tools into a larger systems network with the implication that a boundary cannot be drawn at the individual. This assumption appears to be in contradiction with the tenets of activity theory. Specifically, asymmetry exists between people and things, with the tool acting as a mediator within the context of the activity.

There have been challenges to the cognitive paradigm in software development, predominantly in the field of artificial intelligence, beginning as early as the mid-1980s (Suchman, 1987). The crux of the argument is that the enactment of algorithmic plans in software underlies human action. This calls into question whether human cognition can be modeled as a computer program.

Adherents to activity theory would argue that the resources of the immediate context shape human action, not the computer program. Indeed, Suchman (1987) argues that human action is situated or ad hoc, whereas computer programs follow a predefined path determined in a different context.

Computer-Supported Collaborative Learning

Activity theory provides a developmental framework for computer-supported collaborative learning (CSCL). Koschmann (1996) described CSCL as an emerging paradigm in instructional technology based upon a new set of research practices derived from activity theory. From the very emergence of the field, activity theory has influenced CSCL in a number of ways. Perhaps obvious is the need to consider learning activity in a meaningful context for understanding the design and use of technology. Activity theory provides support for the conceptualization of differences between individual and group learning, and in modeling the context for collaborative learning to occur within. Collaborative learning concepts have been considered in this research study for identification of informal learning activities.

Computer-Supported Collaborative Work

In considering the applicability of activity theory to computer-supported collaborative work (CSCW) (alternately referred to as computer-supported cooperative work), there is no need to argue the crucial importance of understanding the social context. CSCW is used to describe a situated group of people working together with a set of technology tools to achieve a common goal. Similar to CSCL, activity theory was immediately recognized as a conceptual framework for analysis and understanding. Kuutti (1991) proposed activity as basic unit of analysis for CSCW. The other predominant approach in

CSCW is ethnomethodology, which emphasizes the importance of paying attention to detail and avoiding presuppositions in studying complex relations in collaboration. Both activity theory and ethnomethodology recognize that actual work practices are more complex than their formal descriptions.

Whereas a complete review of enabling technologies to support CSCW applications is outside the scope of this literature review, formidable challenges exist in this area. Promise for the future would appear to lie in the continued development of sophisticated Web-based social networking tools for collaboration among virtual teams. In this research study, activity theory provides the conceptual framework for analyzing the collaborative activities of knowledge workers situated in formal and informal collaborative work teams.

Human-Computer Interaction

Human-computer interaction (HCI) has existed for over three decades as a research domain, and as a framework for designing computer-based user interfaces. As a result, HCI is embedded in the curricula for software design professionals. It would seem, therefore, that there is a scientific knowledge base rooted in the information branch of cognitive psychology, for HCI practitioners to draw from. The reality is that research lags practice given constant and revolutionary changes in technology. The effect is such that researchers typically study successful solutions post-implementation—particularly with massively multi-player on-line role-playing games, multi-user virtual environments (MUVEs), and social networking applications—to gain insight as to why they are successful (Kuutti, 1996).

Activity theory provides a major contribution to HCI with an expansion of the field's scope of analysis and subject matter, and in helping to reformulate the

general objective of HCI for extending the range of human performance. Activity theory has provided new perspectives by considering technology as a mediator between human beings and the world, rather than a pole of interaction. HCI was relevant to this research study in considering utility, placement and application of selected tools.

Empirical Research

There is a surprisingly limited body of research around the use and effect of computers and related interactive technology by knowledge workers in everyday office and remote settings. This seems paradoxical as office and knowledge workers comprise the largest group of users for these tools, and investment levels by businesses in interactive technology for performance support is on the rise. In contrast to this reality, there are numerous empirical studies that examine the effect of technology as a mediator of activity in educational settings. Several such studies are cited in this literature review using the theoretical foundations from activity theory as a guide.

Virtual Work Environment – HCI

Increasingly, knowledge workers are expected to collaborate in activities as members of virtual teams. Support for virtual teams has traditionally come under the domain of human-computer interaction (HCI). Since the focus of HCI is on tool design and development, management of the virtual work environment is mostly an individual activity and rarely shared with others (Malone, 1983). This may in itself be a contributing factor to the relative lack of empirical research into problems associated with the virtual desktop.

In one study conducted on knowledge workers in varied digital work environments, three types of information objects were identified (Nardi,

Anderson, & Erickson, 1995). These included: working information, archived information, and ephemeral information. Ephemeral, or short term, information plays a number of roles in individuals' activities, including reminding people about things to be done. This type of information is normally not considered in the design of virtual work environments since the formal logical view of the informational needs of the organization take precedence over users' needs and requirements. In another study, Kaptelinin (1996b) found that users of Macintosh systems in a networked corporate environment shared common issues with organizing information around individual projects, and keeping working and ephemeral information objects separate. In each of these studies related to virtual offices, users developed creative methods to transform their virtual desktops based upon the context of the activities in which they were engaged. Issues arose, however, resulting in conflicts when operating system updates and new applications were propagated to the virtual desktops by the organizational information systems group. The current generation of Web 2.0 social business and collaboration tools are cloud based. What this means is that these types of services are available on any computer or mobile device without the need to install software and data files on a local computer.

Curation in Object Instantiation

In an enterprise study of collaborative work activity, Nardi (2005) applied activity theory in the analysis of multiple motives (objects) in research work conducted in a pharmaceutical company. One of the goals for the study was to extend the research of object-oriented activity to determine how researchers (knowledge workers), with a fair amount of autonomy in their individual research agendas, gain alignment and collaboration on the objects of focused

activity. A term that came up early in the interview process was curation, used to winnow the selection of research and focus activity. Curation was also extended to experimental results. Nardi (2005) makes the point that curation in this context "is a deeply social process through which materials are strategically revealed to others, or hidden from them." This was significant to understanding the way in which objects were substantiated, as well as the determination of what information was available to other members of the community. Curation was systemic, manifested in top-down, bottom-up, and bidirectional processes operating to instantiate the object through which research is delivered to the company. In effect, curation in this context serves as the process through which researchers played with and against the motives of management within different communities of practice. In the context of the activity theory model presented by Engeström (1987), this study illustrates the mediating effect of rules and division of labor (roles) on activity leading to collaborative creation of objects.

CSCL in a Corporate Setting

Collis and Margaryan (2004) reported findings from a study in which work-based activities and computer-supported collaborative learning were used to create and share new knowledge within a globally distributed workforce. By applying activity theory, it was possible to link corporate learning to business performance results. This was accomplished by structuring activities that provided a transformation of objects, in this case knowledge creation and sharing, into performance outcomes including increased competency and business impact. The model for the activity system was adapted from Engeström (1987), and contained the seven main elements: subject, instruments, object, community, rules, division of labor, and outcome. There were distinct challenges

identified in building a collaborative community of learning, however, which included:

- Organizational and social issues
- Time and workplace issues
- Issues relating to involvement of the supervisor
- Issues relating to the multinational setting

Significant changes to the social climate of the work environment are required, affecting the community, rules, and division of labor in order for the benefits of this type of research framework to be fully realized. Activity theory, nonetheless, provided a valuable framework for analyzing the current learning environment in this study. The issues identified in the study conducted by Collis and Margaryan (2004) foreshadowed findings in this research study, explainable by the final set of themes that were identified.

Cultural-Historical Activity Theory

In a study conducted by Blanton, Simmons, and Warner (2001), cultural-historical activity theory (CHAT) was used to positively affect the attitudes and perceptions of pre-service teachers (PSTs) by participation in a learning system designed to promote learning interactions mediated through computer technology and telecommunications. The roots for CHAT are based in the socio-cultural school of activity posited by Vygotsky (1978) and Leontiev (1981). In the context of the study, "learning and development are viewed as primarily social accomplishments achieved through situated moments in the transactions between individuals and the material and social environment, where the transactions between active individuals and an active environment co-construct

each other" (Blanton, Simmons & Warner, 2001). In addition, the study was guided by five principles that are associated with CHAT:

1. Human behavior is social in nature.
2. Human activity is mediated through tools.
3. Communication is central in activity.
4. Values, beliefs, and normative expectations are established through the process of objectification.
5. Learning and development are situated in communities of practice (CoPs).

The first principle embodies Vygotsky's (1978) notion that all higher order psychological functions, including learning and problem solving, emerge first on a social and interpersonal plane, and then later on an internal or intra-personal plane. In the present study, this implies that the meaning of objects, events, methods, values and beliefs for PSTs must be public and accessible to allow for personal connections and interpretations about teaching, learning, and students.

The second principle comes directly from activity theory in the concept of mediation. In the division of labor for PSTs, primary tools include pencils, books, computers, and Web-based technologies used to extend one's self externally in order to transform the environment. In contrast, secondary tools such as language, ideas, and processes allow one to operate internally to transform one's self, and externally to transform the behavior of others.

The third principle, centrality of communication in activity, is based on the notion that thought is completed in the 'word' and that words are culturally shared objects (Vygotsky, 1978). The implication here is that when learners are engaged in formulation and communication about what they are doing, how,

and what it means for another learning is not confined to a single context. This effectively extends the zone of proximal development.

The fourth principle suggests that the meaning of objects, events, and activities reside in the collective group, and not with the individual. As members move in and out of the group, objectified meaning is retained in the collective memory thereby preserving shared beliefs, values, and expectations within the socio-cultural network.

The fifth principle extends activity systems through communities of practice (CoPs). Wenger (1998) characterizes CoPs by three aspects. First, there is mutual engagement, meaning that members interact with each other in many ways. Secondly, there is joint enterprise in which members share in a common endeavor or set of activities. Thirdly, a shared repertoire is developed by the members containing common resources of language, styles and routines by which they are able to express their identities as members of the group. CoPs represent a collective group of individuals engaged in a goal-directed activity, sharing the same values and objects. In CoPs, activities are constituted through social relationships and membership is achieved and continually renegotiated through participation. As individuals are transformed by knowledge and experience, beliefs related to the CoP become part of one's social identity. CoPs can be joined with other CoPs to form social networks, while members typically belong to more than one CoP.

CHAT was applied to transform an introductory course for PSTs based on the principles discussed. The course included student teaching in the local school system. The activity system model, including the seven elements proposed by Engeström (1987), was socially constructed and served as the primary analysis

and design tool. Fifth Dimension was created as an after-school program to provide children with opportunities to engage in activities mediated through computers and telecommunications. Fifth Dimension was used as a boundary object to join the PST CoP with the local school system CoP. This resulted in providing situated learning opportunities for PSTs and enrichment programs for children in the local school system using social learning concepts from activity theory.

Two sources of data were collected in the Fifth Dimension study. The first was an open-ended survey of PSTs administered at the beginning and end of the course. The second was archived field notes that captured student teaching experiences with Fifth Dimension. The results provide evidence of PSTs' struggle to make meaningful connections between course work and field experiences, and subsequent improvements in learning and perception as a result of participation in communities of practice. The transformation was evident in movement away from a view of learning as a linear process toward a view of learning as a social process involving active participation by PSTs and children. "Finally, the study provides evidence that it is possible to design an activity system with learning activity and clinical teaching experiences mediated by computer technology, telecommunications, and multimedia to provide learning interactions promoting changes in PSTs preconceptions of teaching, learning, and pupils" (Blanton et al., 2001).

Conclusions and Research Implications

In researching articles for this literature review, search results citing theoretical research outnumbered empirical research by more than five-to-one in the 167 articles that were reviewed. Part of this disparity may be attributed to the

fact that activity theory, as a cross-disciplinary theory, is fairly complex and spans multiple research domains. The models and vocabulary that have been developed over the past decade have clearly helped to promote understanding of activity theory as evidenced by the available theoretical literature in support of it.

Another limiting factor of the available empirical research studies is that collaborative technology has not been readily available to support the kind of cross-cultural, global collaborated work activities for which activity theory seems ideally suited. The current generation of collaborative and social networking software utilizing Web-based and mobile technologies under the guise of Web 2.0 creates new opportunities for activity theory as a means for describing the mediating affect of technology on social learning and performance. This premise was tested through the empirical research conducted for this study.

Perhaps the greatest challenge to the adoption of activity theory to explain the mediating affects of technology on shared learning and work tied to the achievement of social goals is the ability of people and organizations to evolve from individualistic tool-based work practices to increased collaboration through communities of practice. Direct support for this study was provided in the tenets of activity theory posited by Kaptelinin and Nardi (2006), and the methodological implications summarized by Nardi (1996b).

The theoretical and empirical research reviewed and summarized in this chapter provides evidence of a strong research framework, based in activity theory, used to guide the analysis and methods for this research study. Adoption levels of interactive technology have advanced to the state where it is ubiquitous in the environments where knowledge workers spend the majority of their time.

In general, activity theory provides an analysis framework that has been applied in this study to describe the effect of Web 2.0 technology on informal learning and performance in a social setting. Knowledge workers have unprecedented access to tools for collaboration and production of new knowledge combined with the ability to interact with like-minded individuals within their organizations, institutions, or global communities without leaving their desk. The previous research findings suggest that further study is needed in understanding the mediating effect of interactive technology on informal learning activity and performance at the individual and group level. As I have discussed, this is achievable only in a broader research design that does not discount the mediating effect of rules in the relationship between the knowledge worker and the community he or she is a member of, and the mediating effect of division of labor (roles) on community and performance outcomes of the organization.

Activity theory extends the cognitive theory of distributed cognition by providing a social context and a hierarchy for activity to occur within. This allows for correlation between informal learning (activity/object) and performance (outcome) by drawing a necessary distinction between activity and information artifacts, which are instantiated as objects and mediated by tools (Hutchins, 1995).

The empirical research designs discussed in this literature review provide direct support for the design of this study. The ensuing research design and principles used in this qualitative research study have been fully developed and described in the methodology chapter (Chapter 3), which follows in this dissertation.

Chapter 3

Methodology

The purpose of this qualitative multiple case research study was to explore knowledge workers' perceptions and behavioral intentions related to interactive technology as a mediator for informal learning and performance activities in a professional work setting. I believe that a better understanding of this phenomenon from an emic or insider's perspective is important to extend the theoretical base and inform policy and practice in today's modern workplace. In order to shed light on this phenomenon, this study addressed five research questions:

Q1. What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?

Q2. What are the rules for the use of interactive technology for peer-to-peer and group collaboration?

Q3. How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?

Q4. How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?

Q5. How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?

This chapter describes the study's methodology and includes appropriate developmental discussion in the following areas: (a) rationale for research approach, (b) description of the research setting, (c) research participants, (d) summary of information needed, (e) overview of research design, (f) methods of data collection, (g) analysis and synthesis of data, (h) ethical considerations, and (i) issues of trustworthiness. The chapter concludes with a brief summary statement.

Rationale for Qualitative Research Design

The rationale for a qualitative research design in this study is perhaps best summarized by Merriam (2009, p. 14) in which she states: "qualitative researchers are interested in how people interpret their experiences, how they construct their worlds, what meaning they attribute to their experiences. The overall purposes of qualitative research [therefore] are to achieve an *understanding* of how people make sense out of their lives, delineate the process [rather than the outcome or product] of meaning making, and describe how people interpret what they experience." We know through activity theory that activities are situated in a reality (environment and context)—reified by individuals and social groups—that are linked to an object (performance outcome) (Kuutti, 1996). However, the focus of this research study is not on a particular outcome, but rather on better understanding a set of mediating factors in relationship with actors in order to develop a systemic view of the effect of interactive technology on informal learning and performance affecting knowledge workers in today's modern workplace.

It follows that the qualitative research process employed in this study was primarily *inductive*, meaning that empirical data was used to build concepts,

understanding, and theory rather than deductively testing hypotheses as in positivist research (Merriam, 2009). As discussed in Chapters 1 and 2, this study was informed by a theoretical framework grounded in activity theory, distributed cognition, and the behavior engineering model, which allowed me to focus on inquiry and interpretation of the data. Maxwell (2005, p. 33) described the theoretical framework as "the system of concepts, assumptions, expectations, beliefs, and theories that supports and informs your research." It is important to point out that it was not my intention to test this framework deductively as might be done in an experiment. Rather, the theoretical framework for activity theory, developed in the literature review, provided an underlying structure for framing the research questions and for collection of data. The next section discusses the rationale for selecting case study from among the different types of qualitative research.

Rationale for Multiple Case Study Methodology

Merriam (2009) provides a set of basic characteristics for qualitative study including: focus on meaning, understanding, and process; a purposeful sample; data collection via interviews, observations, documents; data analysis that is inductive and comparative; and findings that are richly descriptive and presented as themes/categories (p. 38). Qualitative case study brings further focus to this paradigm as a means of achieving in-depth description and analysis of a bounded system. This definition seems to suggest both the process for case study and the unit of study have equal bearing on the design and methodology. Yin (2009) places emphasis on the research process. "A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and

context are not clearly evident" (Yin 2009, p. 18). However, Stake (2005) and others point out that case study is less about methodological choice, than a choice of what is to be studied, where the 'what' is the bounded system. The bounded system (or unit of analysis) for this research study is a single organization, thus qualifying it as a case. A case study design was particularly well suited to this study precisely because it is impossible to separate the variables associated with the phenomenon of interest from their context.

This qualitative research study may be characterized as a multiple (collective) case study using Stake's (2005) typology. Specifically, he differentiates case study by the researcher's interest—intrinsic, instrumental, and collective. The intrinsic case study is undertaken "not to come to understand some abstract construct or generic phenomenon…[rather it is] because of an intrinsic interest [in the case]" (p. 445). Instrumental case study is undertaken to provide insight into an issue or to redraw a generalization—the case itself is secondary. In a multiple (collective) case study "a number of cases may be studied jointly in order to investigate a phenomenon, population, or general condition" (p. 445). The multiple case study design was determined most relevant to this research study since the intent was to explore a purposefully selected sample of knowledge workers' perceptions and behaviors related to interactive technology as a mediator for informal learning and performance activities in a particular organizational setting. These collective individualized experiences comprise the case, which is bounded by two U.S. based locations within a single organization.

Description of Research Setting

The research setting for the study is a Canadian-based publicly traded company with operations and employees located worldwide. This setting is further delimited by geographic location, business practice domain area, and functional group.

Geographic Domain

Participants were selected from two operations centers located in separate major Midwestern cities in the United States. Knowledge workers within the two selected locations engage in similar activities and share performance outcomes. These two geographic locations delimit the two cases within the bounded system of study.

Business Practice Domain

The company provides marketing services for Fortune 500 clients (i.e., multinational companies providing products and services to other businesses and consumers). Participants in this study were drawn from three different business practice domains: information technology (IT), business-to-business client services (B2B), and business-to-consumer client services (B2C). Each practice domain is supported within the two selected locations.

Functional Domain

Within a practice area, knowledge workers are assigned to different functional teams such as creative, technology and client services. Because knowledge workers in this setting generally work on cross-functional teams, functional team assignment was not a primary selection criterion.

Research Sample

A purposeful sampling procedure was used in the selection of participants for this qualitative research study. As discussed in the research setting, this study is site-specific and the bounded system under study is intimately linked to two locations in different major U.S. Midwestern cities. The participants selected for the study were all employees of the company at the time of their participation. The participants were male and female, college graduates, with less than ten percent minority representation. The participant age range was between 26 and 65 years. Further, all participants have base skills using interactive technology such as email, content creation and retrieval, and document sharing via the Web.

My intent in this study was to describe a particular context in depth rather than to generalize findings to another setting or population, thus providing the rationale for purposeful sampling (Patton, 2002). "The logic of purposeful sampling lies in selecting information-rich cases, with the objective of yielding insight and understanding of the phenomenon under investigation" (Bloomberg & Volpe, 2008, p. 69). Merriam (2009) adds that purposeful sampling is based on the assumption that the researcher seeks to discover, understand, and gain insight; therefore, he or she must select a sample from which the most can be learned (p. 77). There are several strategies for purposeful sampling summarized by Merriam (2009) and others that are relevant to this study. The first and primary sampling strategy is criterion sampling, which requires that all participants meet one or more criteria as predetermined by the researcher. The preliminary set of criteria used for this study include:

- All participants are classified as knowledge workers,

- Participants have been with the company for at least three years in order to ensure that they understand the culture,
- Participants should have a base level understanding of current Web 2.0 technologies and, at a minimum, have a LinkedIn account, and
- Participants are engaged in activities directly related to new business development for the company.

The second sampling strategy used was stratified purposeful sampling in order to provide insight and understanding of subgroups, thereby facilitating comparisons among them. This allows for differentiation by division of labor (roles) and geographical location (rules). A third and final sampling strategy used is variously referred to as snowball, network, or chain sampling. This strategy is based upon the premise that a few participants who meet the predetermined criteria are selected that are in turn asked to identify or refer others who possess the same or similar characteristics. Patton (2002, p. 237) adds, "by asking a number of people who else to talk with, the snowball gets bigger and bigger as you accumulate new information-rich cases".

Based upon the design for this study, the total sample selected to complete the survey was 30, with 20 participants selected to participate in in-depth interviews. This was considered to be a minimal sample to provide reasonable coverage of the phenomenon given the purpose of the study. The sample was equally distributed across the two site locations, providing two cases for the bounded system. In terms of the optimal number of participants to be included for the study, Lincoln and Guba (1985, p. 202) recommend sampling until a point of saturation or redundancy is reached such that no new information or insights

are forthcoming from newly sampled units. Based on the interview question responses and subsequent categories that emerged, the information and insights gained from the sample were complete.

There were additional relevant descriptive characteristics recorded during the data collection phase of this research study and considered in subsequent analysis and interpretation of findings. These include age of participant, gender, level of education, role, and title.

Sampling Procedures

I met with leadership in both locations to review the purpose of the study as described in the research information sheet, included in Appendix A. Team leaders were asked to recommend members of their teams for participation based on the criterion that were defined in the preceding section.

I subsequently stratified the initial recommended participants by subgroup to ensure distribution across the two case locations, and functional areas of responsibility. I then made either an initial phone or in-person contact with each participant candidate, to invite him or her to participate in the study. If he or she agreed to participate in the study, then I reviewed the research information sheet with the participant and delivered a copy of the information sheet and the survey instrument to the participant in hardcopy, or via email. None of the research candidates contacted declined to participate in the study. Research candidates were informed that they could be selected to participate either in an in-depth interview or a focus group interview, but not both. Most completed surveys (twenty-three) were returned to me via interoffice mail, two were returned via fax.

Summary of Information Needed to Conduct Study

There are four categories of information that were considered necessary in order to answer the five research questions posed in this qualitative multiple case research study. The four categories of information needed are: contextual, perceptual, demographic, and theoretical.

Contextual Information

Context provides insight to the way knowledge workers construct the reality in which activities occur. Thus, contextual information describes the culture and environment for the setting within the unit of inquiry (i.e., the bounded system). Taking the systems view of the activity theory model provided by Engeström (1987), the environmental context for this study is bounded by technology, workgroup roles (division of labor), rules, the community, individual knowledge worker, and the activity/object of focus. Cultural, social, environmental, and personal factors conflate to influence behavior that is tied to context. Cultural and social factors are addressed by the activity theory model; whereas, environmental factors (data, resources, and incentives) and personal factors (motives, capacity, and knowledge) are addressed by the behavior engineering model. Contextual information was collected for this study primarily through in-depth participant interviews.

Perceptual Information

Knowledge workers' perceptions were explored in this research study through extensive interviews conducted individually with participants. These perceptions served to shed light on user experiences leading to emergent patterns to address the research questions posed by the study. Perceptual information was also provided through survey.

Demographic Information

Demographic information pertaining to participants, including role and work group, gender, and age range was collected and coded for each participant as part of the survey process. Such demographic information was considered during survey analysis to provide insight to what may be underlying an individual's perceptions, as well as similarities and differences in perceptions among participants (Bloomberg & Volpe, 2008). Demographic information was also used in the interview process to distinguish between categories for each case.

Theoretical Information

This qualitative research study is informed by an ongoing review of the literature providing theoretical grounding for the study. The theoretical foundation was introduced in Chapter 1 and expanded during the literature review in Chapter 2. The theoretical grounding includes activity theory, distributed cognition, and the Behavior Engineering Model. This grounding was consistently applied, providing support for data interpretation, analysis, and synthesis of the research questions posed by this study in Chapters 4 and 5.

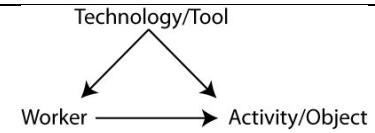
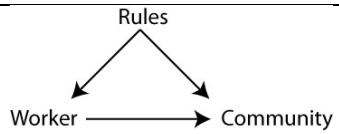
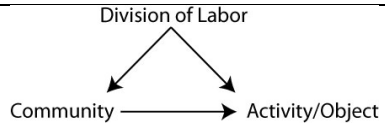
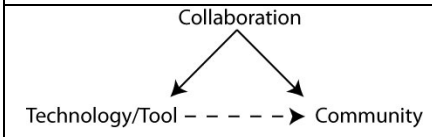
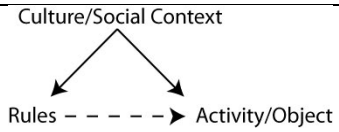
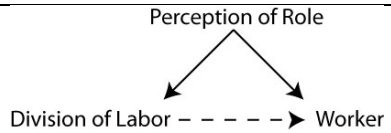
Research Design Overview

The design for this qualitative multiple case research study embodies five essential components identified by Yin (2009). These are: (a) study questions; (b) propositions; (c) unit of analysis; (d) logic linking the data to the propositions; and (e) criteria for interpreting the findings (Yin 2009, p. 27). The research questions were framed by the purpose of the study and have been further refined by an ongoing literature review, providing the underlying theoretical foundation.

The key underlying propositions for this study were derived from Engeström's (1987) activity theory model as illustrated in Figure 2. Specifically, there are six mediated relationships that are believed to influence individual and group activities tied to performance. Each of these relationships was considered in the context of this study and was supported by the research questions. These relationships are summarized in Table 1.

Additional propositions for this study are derived from the literature review. Specifically, Nardi (1996b, p. 95) identifies a set of methodological implications for using activity theory as a descriptive theory in qualitative research. These have been discussed in detail in the literature review and include: a research time frame long enough to fully address the research questions; attention to broad patterns of activity; use of a varied set of data collection techniques; and a commitment to understanding things from participants' points of view.

Table 1
Relationships affecting Individual and Group Performance and role of Mediation (Source: T. Boileau)

Relationship	Definition
	The relationship between the worker and the activity/object is mediated by the availability of interactive technology tools. In this context, an activity represents an informal learning activity, which is sub-classified into actions and operations. The object represents the top-level performance goal for the activity.
	The relationship between the worker and the community that he or she is a part of is mediated by a set of rules. Rules may encompass business/work rules, contractual obligations, standards, regulations, policies, and procedures.
	The division of labor mediates the relationship between the community and the activity/object. The community may be either formally or informally established depending upon the level of specialized skills needed to achieve the required performance outcome and the social structure of the organization.
	An implied relationship exists between the technology/tool and the community, and is mediated by the level of collaboration facilitated by the community. How does the level of collaboration within internally and externally situated communities of practice socially mediate the affect of technology?
	An implied relationship exists between rules and the activity/object, and is mediated by the cultural setting and social context in which the activity occurs. How do different cultures and social settings (e.g., geographical separation and virtual teams) affect how rules are interpreted in activity-based performance?
	An implied relationship between the division of labor and the worker is mediated by the worker's perception of the role affecting his or level of participation. How does this perception affect motivation to use interactive technology tools for self-directed informal learning activities to achieve a performance outcome?

The unit of analysis for this multiple case design has been discussed at length in this section, so is summarized here. The bounded system is comprised of two U.S. locations within the same company. The logic for two locations is to understand the cultural and social influence of different geographical locations described in the research setting. Participants selected for interview were equally distributed between the two locations.

Logic linking the data to the propositions provided guidance for the data analysis and interpretation in Chapter 4. A range of analytic techniques were used for linking the data to propositions including pattern matching, construction of logic models, theme development, and cross case synthesis (Yin 2009, p. 34).

The fifth component, criteria for interpreting the study's findings, was fully developed and explained in Chapter 4, with a full description of the processes used for data collection, analysis and synthesis. Focus on criteria development for interpretation of findings during the research design phase was extended during analysis for planning and enumeration of rival explanations, enabled by an ongoing review of the literature.

Methods of Data Collection

Multiple methods of data collection were used in this multiple case qualitative research study to provide triangulation of data sources for strengthening internal validity. The qualitative data collection methods used were survey, interview, and field notes. These methods were fully aligned with the research questions and information needed as mapped in Table 2.

Table 2
Research Questions, Information Needed and Data Collection Methods

Research Questions	Information Needed	Method
1. What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?	Participants' perceptions, attitudes, and behavioral factors that influence selection and adoption of interactive technology in activities.	Survey Interview Field notes
2. What are the rules for the use of interactive technology for peer-to-peer and group collaboration?	Perceived organizational and personal barriers linked to work setting rules restricting the use of interactive technology tied to setting.	Interview Survey
3. How does the division of labor (i.e., separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?	Perceived mediating effects of division of labor on activity within the community of practice.	Interview Field notes
4. How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?	Perceived mediating effects of social and cultural context on interpretation of rules governing activities.	Interview Field notes
5. How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?	Behavioral and motivational factors linked to participants' perception of role affecting use of technology for self-directed informal learning activities.	Interview Survey Field notes

Survey

A survey was administered prior to interviewing the candidates with the expectation that the quantitative data obtained would provide insight to questions 1, 2, and 5 in Table 2. The survey instrument selected assesses technology acceptance using a Likert scale for recording participant response to each statement. Each of the statements used in the first five categories of the survey has been empirically validated by Venkatesh, Morris, Davis, F. and Davis, G. (2003) in formulation of the *Unified Theory of Acceptance and Use of Technology*. This accounts for 19 items arranged in the following five categories: performance expectancy, effort expectancy, extrinsic social influence, facilitating conditions, and behavioral intention to use the system. In the context of this qualitative research study, 'system' refers to the collective social learning and performance technologies that the participant audience has been exposed to. A sixth category, implicit social influence, provides five additional items for a total of 24. These items have been empirically validated in research by Kim, Jahng, and Lee (2007) in development of the *Utilization-based Information Technology Success Model*. This category extends the research of Venkatesh et al. (2003) by examining implicit, in addition to explicit social influence, on technology acceptance and usage. In addition to the 24 statements, the survey instrument also contained certain profile information for use in coding responses. A copy of the survey instrument is included in Appendix B.

Instrument Validation. Five knowledge workers employed by the organization targeted by the study, who met the stated selection criteria for this study, reviewed the survey instrument. Feedback was received resulting in

changes to the survey instructions. None of the previously validated survey statements were modified.

Instrument Procedure. The survey was distributed to all participants either in hardcopy or via email, upon review of the research information sheet. 25 participants completed and returned the survey. Upon receipt of each survey, I replaced the participant's name with a code number and entered the data into the research database.

Semistructured Interview

In-depth interviews, as described by Yin (2009, p.107), were conducted with 20 purposefully selected participants within the bounded system comprising this qualitative multiple case research study. Interviews were semistructured as defined by Merriam (2009, pp. 89-90). In a semistructured interview, the interview guide (please see Appendix C) includes a mix of more and less structured questions linked to the research questions for this study. Questions were used flexibly allowing the participant to propose his or her own insights into specific occurrences and experiences. This interview type was selected because it encourages the interviewee to serve as an informant as opposed to a respondent in a more conversational manner.

Time allowed for in-depth interviews was kept to one hour. Data collection during interviews was through digital audio recording and also in field notes taken by the researcher. It was expected that approximately half of the interviews would occur face-to-face, with the remaining interviews by phone or phone/video using Skype™. In actuality, 18/20 interviews were conducted in person. Information gained from the interview process provided insight into all five of the research questions listed in Table 2.

Instrument Validation. Two colleagues and three knowledge workers who met the stated criteria for this study reviewed and validated the interview protocol questions. Minor wording changes were made.

Instrument Procedure. I made consistent use the interview guide (Appendix C) when conducting the interviews and it was not distributed to the participants. The order of the questions did not vary, however, appropriate use of follow-up questions was employed to add clarity and understanding, providing flexibility for the participant to share his or her own insights in relating perceptions and experiences. Interviews were scheduled for one-hour.

Interviews were digitally recorded for transcription into the research database, along with my notes taken during the interview process. The format for the interview transcript included line-numbering down the left-hand side of the page to aid in subsequent analysis and reference to verbatim comments used in the discussion in Chapter 5. The code numbers created for processing the survey data were used in place of the interviewee's name as an added protection of confidentiality.

Researcher Journal/Field Notes

Although it is not a direct data collection method for participant information, the final method used in this qualitative research study is the researcher journal. Lincoln and Guba (1985) refer to this as a reflexive journal, the purpose of which is to provide "…introspective journals that display the investigator's mind processes, philosophical position, and bases of decisions about the inquiry" (p. 109). Daily or weekly journal entries include sections for 1) daily schedule and logistics of the study, 2) a personal diary for reflexive observation and early insights, and 3) a methodological log in which

methodological decisions and accompanying rationales are recorded (p. 327). By providing information about methodological decisions made and the reasons for making them, the researcher journal contributes to the study's audit trail by providing useful material to support validity claims.

Schedule for Data Collection

Phase I: Survey – 2 weeks during January 1011. Potential participants were contacted using selection criteria for purposeful selection of sample. Individuals selected to participate were briefed on the study using the research information sheet (Appendix A), and received a copy of the document for their file. Completed surveys were returned to me via inter-office mail or fax during the month of January.

Phase II: Interviews – 6-8 weeks during January-February 2011. I scheduled interviews with participants using email and Microsoft Outlook calendaring services available on the company intranet. At the beginning of each interview, I reviewed the purpose of the study and protections of confidentiality.

Methods for Data Analysis and Synthesis

In general, the preferred approach to data analysis in a qualitative research study is to begin rudimentary analysis simultaneously with data collection (Merriam, 2009). In this respect, data collection and preliminary analysis are both linked and iterative in terms of an ongoing process that can extend indefinitely. Lincoln and Guba (1985) provide a set of rules to guide a "stop collecting and processing" decision. The four criteria given are: 1) exhaustion of sources, wherein all sources have been fully reviewed and coded; 2) saturation of categories, in which only tiny increments of new information are being added; 3) emergence of regularities, when identifiable patterns begin to provide a sense of "integration", and; 4) overextension, identifiable by a situation where new information added is outside of the scope of the study as defined by the research questions (p. 350).

In this qualitative research study, multiple data sources have been identified including: survey, interviews, and field notes. Given the preponderance of data, even with the relatively small sample size, data management and organization beginning at the outset of data collection was key to analysis. Data management was facilitated by the appropriate use of database, spreadsheet and word processing software. Organization of data was managed using a coding system based on meta-tags to identify and refine categories of information linkable to the research questions. Coding (tagging) of data began with the first interview. These initial tags were applied and iteratively refined with each subsequent interview transcript and set of field notes in a categorical schema used for analysis and development of a set of categorical themes,

ultimately reduced to five for synthesis of the findings to address the research questions.

The most difficult part of qualitative research is analysis of the data (Merriam, 2009; Yin, 2009). Merriam (2009) asserts, "all qualitative data analysis is primarily *inductive* and *comparative*" (p. 175). This draws from the seminal work of Glaser and Strauss (1967) on the use of the constant comparative method of data analysis as a means for developing grounded theory. The constant comparative method has since been generalized, and today is widely used by other qualitative research traditions including case study. Specific to this research study, each particular insight or incident revealed from an interview, field note, or survey was compared to other instances in the same data set forming an initial set of categories. These comparisons continued throughout the data collection period looking for specific patterns that ultimately emerged from the data. Pattern matching logic was used to compare empirically based patterns drawn from this research study, creating a set of themes related to the activity-based patterns discussed in the literature review. The coincidence of patterns in the early findings helped to strengthen internal validity of the study (Yin, 2009).

Because two cases were examined in this multiple case qualitative research study, specific to the two locations in the bounded system, an additional level of analysis was added using cross-case synthesis (Yin, 2009). Once the initial analysis of each case was completed, cross-case synthesis began. This method of synthesis enabled inductive building of abstractions across the two cases in the final stage of analysis. While the details of the two cases showed expected variance linked to culture and setting of the different locations, this

method provided a general explanation that fit both cases for purposes of addressing the research questions.

During the analysis, described in detail in Chapter 4, attention was given to four principles believed to underlie all good social science research (Yin, 2009). The first is to show that the researcher attended to *all the evidence*. This means that the analytic methods have fully covered the research questions and that all evidence was fully considered. The second principle is that the analysis, if possible, should address *all major rival interpretations*. This implies an ongoing review of the literature. The third principle is that the analysis should address *the most significant aspect* of the case study. This requires a careful review of the purpose and research questions for this study to ensure that they have been addressed. The final principle is that the researcher uses his *prior, expert knowledge* in the case study. These principles demonstrate awareness of the current thinking and discourse around the case study method of qualitative research as applied to this study.

Ethical Considerations

Throughout this qualitative research study, utmost consideration was given to protection of the participants. As Stake (2005) observes, "Qualitative researchers are guests in the private spaces of the world. Their manners should be good and of ethics strict" (p. 459). Interviewing carries with it both risks and benefits to the informants (Merriam, 2009). As the principal investigator for this study, I took personal and professional responsibility for both informing and protecting participant-respondents. The research processes used required voluntary cooperation and followed the basic premise that participants be informed about the study's purpose, risks and benefits, data storage to protect

confidentiality, and how the results of the study would be used. It was not anticipated that the study would pose any serious ethical threats or harm to participants' well being, and appropriate safeguards were employed.

First, informed consent was gained using the research information sheet (Appendix A). Second, participants who volunteered to participate in this research were assured anonymity by keeping names and other identifying characteristics of the participants and organization confidential. Finally, security measures were employed for storage of research-related records and data, with sole access granted to myself.

Issues of Trustworthiness

In this qualitative research study, issues of trustworthiness required me to extend the concepts of internal and external validity of the study and reliability of the findings typically associated with quantitative research, while ensuring the investigation was conducted in an ethical manner. Differences exist between qualitative and quantitative research in terms of the set of assumptions about the reality under consideration and the worldview in which the investigation takes place (Merriam, 2009). For this reason, Lincoln and Guba (1985) have introduced different terms to describe trustworthiness in qualitative research. Specifically, the terms credibility, transferability, dependability, and confirmability are now widely used in discussing trustworthiness in qualitative research. The remainder of this section considers how each of these four criteria of trustworthiness have been addressed in this research study.

Credibility

The criterion of credibility addresses the traditional notion of internal validity in this qualitative research study. This criterion effects whether the

findings are viewed as accurate and credible from the perspective of the researcher, the informants, and the reader while also informing the research design. Credibility was addressed in this study through attention to methodological and interpretative validity (Mason, 1996).

Methodological validity relates the appropriateness of the methods selected to the research questions being asked by the study. This type of validity encompasses a holistic view of the study's purpose, theoretical framework, research questions, and methods as they relate to the research design (Bloomberg & Volpe, 2008). Interpretive validity addresses the validity of the data analysis methods and interpretations on which it is based. While interpretive validity is somewhat dependent on methodological validity, it goes further by examining the quality and rigor with which the researcher interprets and analyzes data based on the research design (Mason, 1996).

Methodological validity in this qualitative research study was provided by triangulation of multiple methods and multiple sources of data. Triangulation of methods was done by comparing information gained in interviews with information collected from the survey and field notes relevant to the question of interest. Triangulation of data sources in this study was facilitated by comparing and cross-checking in-depth interviews with different participants holding different perspectives, and with data collected from surveys. Cross-case synthesis of the two cases, included in the research design and analysis for this study further contributed to methodological validity.

Interpretive validity for this qualitative research study was provided using a number of strategies. First, I clarified my assumptions up front and maintained a journal of critical reflection, philosophical position, and basis for

any methodological changes. Additionally, I used member checks with participants, and peer review/examinations to identify variations in understanding of the data and to challenge my emergent findings.

Transferability

The criterion of transferability addresses the traditional notion of external validity in this qualitative research study. In quantitative research, external validity is concerned with the extent to which findings of one study may be transferred or applied to other situations. That is to say, how generalizable are the results of the research study? In this study, the bounded system included two cases with a purposefully selected group of participants, precisely because I was trying to understand a particular phenomenon in depth, and not to find out what is generally true of many. It is left to the reader to determine whether and to what extent this particular phenomenon in this particular context might transfer to another particular context. Lincoln and Guba (1985) address the notion of transferability in qualitative research in which "the burden of proof lies less with the original investigator than with the person seeking to make an application elsewhere. The original inquirer cannot know the sites to which transferability might be sought, but the appliers can and do." The investigator, however, has an obligation to include "sufficient descriptive data" to make transferability possible (p. 298). Patton (2002) suggests the use of extrapolating rather than making generalizations since extrapolations are more problem oriented. Such speculations may find application to other situations under similar but not identical situations.

To enable transferability in this qualitative research study, *rich, thick description* of the participants and context was the principal strategy used. Rich,

thick description is a term of art that "has come to be used to refer to a highly descriptive, detailed presentation of the setting and in particular, the findings of the study…with adequate evidence presented in the form of quotes from participant interviews, field notes, and documents" (Merriam, 2009, p. 227). Lincoln and Guba (1985) identify rich, thick description as the best way to ensure the possibility of transferability, by providing the reader with sufficient context to assess the similarity and applicability of the study to other settings.

Dependability

The criterion of dependability addresses the traditional notion of reliability in this qualitative research study. In quantitative research, reliability defines the extent to which research findings can be replicated if the study were repeated. This definition is problematic in social science research "because human behavior is never static, nor is what many experience necessarily more reliable than what one person experiences" (Merriam, 2009). Therefore, in this research study, the question of dependability is addressed by *whether the results are consistent with the data collected*. Lincoln and Guba (1985) first conceptualized reliability in qualitative research as dependability or consistency. Rather than demanding that outsiders get the same results, the researcher seeks concurrence from outsiders that given the data collected, the results make sense. If the findings of this study are determined to be consistent with the data that was presented, then the study can be considered dependable. If, on the other hand, inconsistencies were found in the findings of this research study, the full body of evidence presented would point to an understanding of how and why the inconsistencies might have occurred.

To ensure dependability in this qualitative research study, I have fully documented the procedures and have demonstrated that coding schemes and categories were applied consistently through inter-rater reliability. Strategies for ensuring dependability have been discussed for the notion of credibility, including triangulation of methods for collecting and analyzing data for methodological validity, and peer review and member checks for interpretive validity. Lincoln and Guba (1985) recommend the use of an *audit trail* as a method for strengthening dependability. The audit trail in this research study provides detail of how data were collected, how categories were derived, and how decisions were made throughout the inquiry (Merriam, 2009, p. 223). The audit trail was facilitated by the researcher journal as the research was undertaken.

Confirmability

The criterion of confirmability addresses the traditional notion of objectivity in this qualitative research study. In quantitative research, the notion of objectivity is applied to research settings, which are relatively value-free, and therefore objective. The research design for this study relied on participant perceptions that are value-bound and thus considered to be subjective. In quantitative research, subjectivity leads to results that are both unreliable and invalid. Lincoln and Guba (1985) deal with this issue with the notion of confirmability in qualitative research. Confirmability is the degree to which the researcher can demonstrate the neutrality of the research interpretations. This required that an audit trail be maintained and subsequently available to independent readers. The audit trail provides traceability of findings using: 1)

raw data; 2) analysis notes; 3) reconstruction and synthesis products; 4) process notes; 5) personal notes; and 6) preliminary developmental information.

Summary Statement

In summary, this chapter has provided a description of this study's research methodology. A qualitative multiple case study methodology was selected to gain insight into knowledge workers' perceptions and behaviors related to interactive technology as a mediator for informal learning and performance activities in a professional work setting. The sample and setting for the research study have been defined, as have the data collection methods and methods used for data analysis and synthesis. Ethical considerations and issues of trustworthiness have been addressed with appropriate review of the emergent body of literature for qualitative research.

The next chapter (Chapter 4) in this dissertation provides in-depth analysis and presentation of findings from the research data that was collected in this study. Rich, thick description of the findings has been provided for the reader, with sufficient context to assess the similarity and applicability of the study to other settings, thus enabling transferability (Lincoln & Guba, 1985).

Chapter Four

Analysis

This chapter provides the completed analyses of the survey and interview data that were collected as part of this qualitative multiple case research study. The purpose of this analysis is to provide insight by answering the research questions:

Q1. What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?

Q2. What are the rules for the use of interactive technology for peer-to-peer and group collaboration?

Q3. How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?

Q4. How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?

Q5. How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?

Because this study employed a mixed methods approach for data collection using the research instruments that were selected and validated, both quantitative and qualitative methods were utilized in the data analysis. Analysis of the research survey data provided a set of themes initially used to increase internal reliability of the study. These themes were subsequently applied during

later stages of the interview data analysis, to yield a final set of mutually exclusive, empirically derived categories encompassing the twelve interview questions, thereby providing necessary context to answer the research questions asked in this study. The remainder of this chapter is organized in five sections: sample description, survey data analysis, interview data management, interview data analysis, and summary of analyses.

Sample Description

A total of twenty-five employees, out of a sample of thirty, within the same company participated in this research study from two office locations situated in different major U.S. Midwestern cities. The research locations are referred to as Loc1 and Loc2. There are approximately one hundred employees based in Loc1, which is a regional office. There are approximately eight hundred employees based in Loc2, which serves as the corporate headquarters for U.S. operations. Participants in this study were drawn from three different business units: information technology (IT), business-to-business client services (B2B), and business-to-consumer client services (B2C).

All twenty-five participants completed the survey (Appendix B). Twenty of the participants, ten from each location, took part in in-depth interviews that I conducted, using the interview protocol (Appendix C) for this study. Eighteen of the interviews were conducted face-to-face and two interviews (Loc2) were conducted via telephone.

All participants in this research study are considered to be knowledge workers. For the purposes of this study, a knowledge worker is defined as someone whose primary job focus is the accumulation, processing or analysis of data and information, as opposed to physical goods, and is valued for his or her

ability to interpret information within a specific subject area. Three of the knowledge workers that participated in this study were vice presidents, four were directors, six were managers, and the remaining participants were all senior associate level employees. Approximately forty-five percent (11/25) of the participants were female and the majority (13/25) was between the ages of thirty-six and forty-five years of age. Participant sample demographic information is summarized in Table 3.

Table 3
Summary of Participant Demographic Information

Instrument	n	Location		Business Unit			Gender		Age Range			
		Loc1	Loc2	IT	B2B	B2C	Female	Male	26-35	36-45	46-55	56-65
Survey	25	12	13	6	11	8	11	14	3	13	7	2
Interview	20	10	10	4	9	7	9	11	2	11	6	1

Survey Data Analysis

Survey Protocol

An email message was sent to thirty purposefully selected participants for this research study on January 4, 2011. Fifteen emails were sent to employees assigned to Loc1 (location one) and fifteen emails were sent to employees assigned to Loc2 (location two). The email provided participants with a brief introduction to the study, two attached pdf files, and a set of instructions. The attached files included were: the research information sheet (Appendix A) describing the study and role of the participant in the study, and the validated survey instrument (Appendix B). The instructions provided guidance to complete the survey and then return it via interoffice mail or by fax. Follow up with each selected participant, by phone or in person, occurred between January 4 and January 6, 2011 to review the research information sheet and answer any questions. At that time, none of the selected participants declined to participate

in the study. Two follow-up emails were sent on January 14 and on January 21, 2011, to participants who did not return surveys. The five participants who did not participate in the study cited time or travel constraints as the primary causes for their lack of participation.

A total of twenty-five surveys were completed and returned, which were encoded using a unique identifier for each participant, entered into the database, and used in subsequent analysis. The distribution of completed surveys between Loc1 and Loc2 was twelve and thirteen, respectively. Additional demographic information related to the survey instrument is provided in Table 3.

Description of Statistics

A series of models were applied to the survey data using SPSS in order to interpret the data collected in the study. The survey included twenty-four questions grouped within six main constructs: performance expectancy; effort expectancy; explicit social influence; facilitating conditions; behavioral intention; and implicit social influence. For response analysis, the twenty-four questions were coded using an interval scale of measurement, rather than an ordinal scale. This method is commonly used provided there are five or more response categories and the underlying construct is conceptualized as theoretically continuous (Tabachnick & Fidell, 2001).

Cronbach's alpha coefficient. For each of the six constructs, the mean was calculated for each question and Cronbrach's alpha coefficient was calculated for each construct group. Cronbach's alpha is not a statistical test per se; rather it is a coefficient of reliability (or consistency) for the group construct. In this research study an alpha greater than .70 is considered to be an acceptable indicator of internal consistency, which is consistent with other instruments of this type

(Venkatesh et al., 2003). A high value of alpha is used here as evidence that the grouped items measure an underlying (or latent) construct.

Pearson's correlation coefficient. Correlations were constructed in order to understand the relationship strength and direction between two continuous variables by examining all possible combinations of the six constructs. This was done using Pearson's correlation coefficient "r" with two-tailed option for test of significance.

Hierarchical regression. Hierarchical multiple regression analysis was applied to the dataset to provide a predictive measure of effect for each construct. Specifically, a hierarchical regression model was constructed to estimate the causal effect of the various constructs on behavioral intention using sample demographics (i.e., intervening variables) as a baseline measurement.

Curve fit. Linearity of fit was examined by constructing visual models to show the effect of each of the first five constructs—performance expectancy; effort expectancy; explicit social influence; and facilitating conditions—on behavioral intention as the dependent variable.

Performance Expectancy (Questions 1-4)

In this research study, performance expectancy is defined as the degree to which an individual perceives using interactive technology will help him or her to attain gains in job performance. Cronbach's alpha coefficient value of .875 in this grouping indicates medium to high reliability of internal consistency for this construct. This suggests that knowledge workers in this study perceive the use of interactive technology as a way to increase effectiveness and personal performance in their job. Increased variability and a lower mean in Q4 may call

into question the value of extrinsic motivation as a factor in personal expectation of performance.

Table 4
Reliability Statistics – Performance Expectancy

Reliability Statistics

Cronbach's Alpha	N of Items
.875	4

Item Statistics

	Mean	Std. Deviation	N
Q1. I find interactive technology useful in performing my job.	6.4000	1.32288	25
Q2. Use of interactive technology enables me to accomplish tasks more quickly.	6.1200	1.36382	25
Q3. Use of interactive technology increases my productivity.	6.4000	.91287	25
Q4. If I use interactive technology, I will increase my chances of getting a raise.	4.7600	1.94251	25

Effort Expectancy (Questions 5-8).

In this research study, effort expectancy refers to how easy it is for a knowledge worker to use interactive technology. Cronbach's alpha coefficient value of .752 in this grouping indicates fair reliability of internal consistency for the grouping. Effort expectancy in this grouping as it relates to perceived ease of use of interactive technology in the workplace, suggests that knowledge workers

in this study are generally comfortable with learning and using interactive technologies.

Table 5
Reliability Statistics – Effort Expectancy

Reliability Statistics

Cronbach's Alpha	N of Items
.752	4

Item Statistics

	Mean	Std. Deviation	N
Q5. My use of interactive technology is clear and understandable in my job.	5.52000	1.417745	25
Q6. It is easy for me to become skillful at using new interactive technology.	5.52000	1.557776	25
Q7. I generally find interactive technology easy to use.	5.60000	1.080123	25
Q8. Understanding how to operate interactive technology is easy for me.	5.52000	1.446836	25

Explicit Social Influence (Questions 9-12)

Explicit social influence, in this research study, is defined as the degree to which a knowledge worker perceives that other people, in positions of authority, believe that he or she should use the interactive technology. Cronbach's alpha coefficient value of .794 in this grouping indicates medium reliability of internal consistency for the grouping. This suggests a culture and setting that is supportive of the use of interactive technologies, or at the least is not a deterrent.

Table 6
Reliability Statistics – Explicit Social Influence

Reliability Statistics

Cronbach's Alpha	N of Items
.794	4

Item Statistics

	Mean	Std. Deviation	N
Q9. People who influence my behavior think that I should use interactive technology.	5.4000	1.55456	25
Q10. People who are important to me think that I should use interactive technology.	5.6000	1.52753	25
Q11. Senior management encourages the use of interactive technology.	5.2800	1.74452	25
Q12. In general, my organization has supported the use of interactive technology.	5.5200	1.35769	25

Facilitating Conditions (Questions 13-16)

Facilitating conditions in the context of this research study is defined as the degree to which a knowledge worker believes that an organizational infrastructure exists to support and use the interactive technology. Cronbach's alpha coefficient value of .394 in this grouping indicates very low reliability of internal consistency for the grouping. Combined with lower means and increased variability, the elements of facilitating conditions grouping do not measure the same thing, making it the least desirable measure of all of the

constructs for this study. This is consistent with research cited by Venkatesh et al. (2003), indicating that when both performance expectancy constructs and effort expectancy constructs are present, facilitating conditions become non-significant in predicting behavioral intention. This may also suggest a perceived lack of systemic planning and support for interactive technologies within the community for knowledge workers who participated in this study.

Table 7
Reliability Statistics – Facilitating Conditions

Reliability Statistics

Cronbach's Alpha	N of Items
.394	4

Item Statistics

	Mean	Std. Deviation	N
Q13. I have the resources necessary to use interactive technology in my job.	5.1600	1.21381	25
Q14. I have the knowledge necessary to use interactive technology in my job.	5.6000	1.35401	25
Q15. Interactive technology is often not compatible with other systems I use. (reverse coded)	4.4000	1.38444	25
Q16. A specific person (or group) is available for assistance with system difficulties.	4.8800	1.42361	25

Behavioral Intention (Questions 17-19)

Behavioral intention in the context of this research study refers to changes in activity, or changes in intention to use interactive technology as a result of other influences. Cronbach's alpha coefficient value of .635 in this grouping indicates somewhat low reliability of internal consistency for the grouping. Even with higher means, validity of this construct would be called into question as a singular measure for this study. It may also suggest ambivalence on the part of knowledge workers participating in this study, not knowing how they will use interactive technology in performing their job during the ensuing three months. As will be shown, behavioral intention typically does not manifest on its own accord; rather, it is dependent on other variables.

Table 8
Reliability Statistics – Behavioral Intention

Reliability Statistics

Cronbach's Alpha	N of Items
.635	3

Item Statistics

	Mean	Std. Deviation	N
Q17. I intend to use new interactive technologies in the next 3 months.	6.0000	1.50000	25
Q18. I predict I will increase my use of interactive technology in the next 3 months.	5.6800	1.10755	25
Q19. My job requires me to use interactive technology in the next 3 months.	5.8400	1.54596	25

Implicit Social Influence (Questions 20-24)

Implicit social influence, in this research study, is defined as the degree to which knowledge workers' social connections influence the way that he or she uses interactive technology. Cronbach's alpha coefficient value of .866 in this grouping indicates medium to high reliability of internal consistency for the grouping. This suggests a strong perception that other members within the community are actively using interactive technology in performance-based activity. It also provides an interesting data point in that the means suggest the higher up you travel in the organization, there is less perceived use of interactive technologies.

Table 9
Reliability Statistics – Implicit Social Influence

Reliability Statistics

Cronbach's Alpha	N of Items
.866	5

Item Statistics

	Mean	Std. Deviation	N
Q20. My colleagues frequently use interactive technology for their job-related tasks.	6.2800	1.10000	25
Q21. My coworkers frequently use interactive technology for their job-related tasks.	6.0800	1.18743	25
Q22. My supervisor frequently uses interactive technology for his or her job-related tasks.	5.1600	1.59896	25
Q23. My subordinates frequently use interactive technology for their job-related tasks.	5.6800	1.37598	25
Q24. My company's executives frequently use interactive technology for their job-related tasks.	4.9600	1.24097	25

Correlations

Reviewing Table 10, correlation is significant at the 0.01 level (2-tailed) in the following pairs of constructs:

- Performance Expectancy— Explicit Social Influence (r=.769)
- Effort Expectancy — Facilitating Conditions (r=.698)
- Performance Expectancy — Behavioral Intention (r=.690)

Correlation is significant at the 0.05 level (2-tailed) in the following pairs of constructs:

- Explicit Social Influence — Behavioral Intention (r=.472)

- Performance Expectancy — Facilitating Conditions (r=.426)
- Implicit Social Influence — Behavioral Intention (r=.419)
- Effort Expectancy — Explicit Social Influence (r=.406)
- Explicit Social Influence — Facilitating Conditions (r=.397)

Table 10
Correlations

Correlations

		Performance Expectancy Mean	Effort Expectancy Mean	Explicit Social Influence Mean	Facilitating Conditions Mean
Performance Expectancy Mean	Pearson Correlation	1	.342	.769**	.426*
	Sig. (2-tailed)		.095	.000	.034
	N	25	25	25	25
Effort Expectancy Mean	Pearson Correlation	.342	1	.406*	.698**
	Sig. (2-tailed)	.095		.044	.000
	N	25	25	25	25
Explicit Social Influence Mean	Pearson Correlation	.769**	.406*	1	.397*
	Sig. (2-tailed)	.000	.044		.049
	N	25	25	25	25
Facilitating Conditions Mean	Pearson Correlation	.426*	.698**	.397*	1
	Sig. (2-tailed)	.034	.000	.049	
	N	25	25	25	25
Behavioral Intention Mean	Pearson Correlation	.690**	.099	.472*	.030
	Sig. (2-tailed)	.000	.637	.017	.885
	N	25	25	25	25
Implicit Social Influence Mean	Pearson Correlation	.255	-.102	.388	-.015
	Sig. (2-tailed)	.219	.626	.055	.943
	N	25	25	25	25

Correlations

		Behavioral Intention Mean	Implicit Social Influence Mean
Performance Expectancy Mean	Pearson Correlation	.690**	.255
	Sig. (2-tailed)	.000	.219
	N	25	25
Effort Expectancy Mean	Pearson Correlation	.099	-.102
	Sig. (2-tailed)	.637	.626
	N	25	25
Explicit Social Influence Mean	Pearson Correlation	.472*	.388
	Sig. (2-tailed)	.017	.055
	N	25	25
Facilitating Conditions Mean	Pearson Correlation	.030	-.015
	Sig. (2-tailed)	.885	.943
	N	25	25
Behavioral Intention Mean	Pearson Correlation	1	.419*
	Sig. (2-tailed)		.037
	N	25	25
Implicit Social Influence Mean	Pearson Correlation	.419*	1
	Sig. (2-tailed)	.037	
	N	25	25

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Hierarchical Regressions

A series of six incremental models were applied in regression analysis of the survey data for this research study. Intervening demographic variables were used in establishing a baseline including gender, age range, group affiliation, and location. Subsequent steps include performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence. The models are summarized in Table 11.

Table 11
Regression Models

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Gender, Age Recoded to Range Mean, Group, Location	.	Enter
2	Performance Expectancy Mean	.	Enter
3	Effort Expectancy Mean	.	Enter
4	Explicit Social Influence Mean	.	Enter
5	Facilitating Conditions Mean	.	Enter
6	Implicit Social Influence Mean	.	Enter

a. All requested variables entered.
b. Dependent Variable: Behavioral Intention Mean

A significant change in Adjusted R Square occurs in model 2 with the addition of performance expectancy. As shown in Table 12, this accounts for 55.8% of behavioral intention. Additional factors have little effect, in some cases appearing as a negative effect. In summary, the limited sample size raises questions as to the validity of regression analysis for this data set. It does provide an early indicator, however, that performance expectancy is a key determinant of

behavioral intention in the context of this research study, which is why I have chosen to include it as a statistical test.

Table 12
Regression Model Summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.300[a]	.090	-.092	1.11138
2	.806[b]	.650	.558	.70728
3	.807[c]	.651	.535	.72511
4	.807[d]	.652	.509	.74544
5	.830[e]	.689	.534	.72582
6	.858[f]	.736	.577	.69149

Curve Fit

The curve fit is modeled by using the calculated means for each construct. In each graph, behavioral intention is the dependent variable. As shown in Figure 4, the strongest linear curve fit, suggesting a corresponding effect on behavioral intention, is with implicit social influence, performance expectancy, and (explicit) social influence. Less of a curve fit is noticeable for facilitating conditions and effort expectancy in terms of effect on behavioral intention.

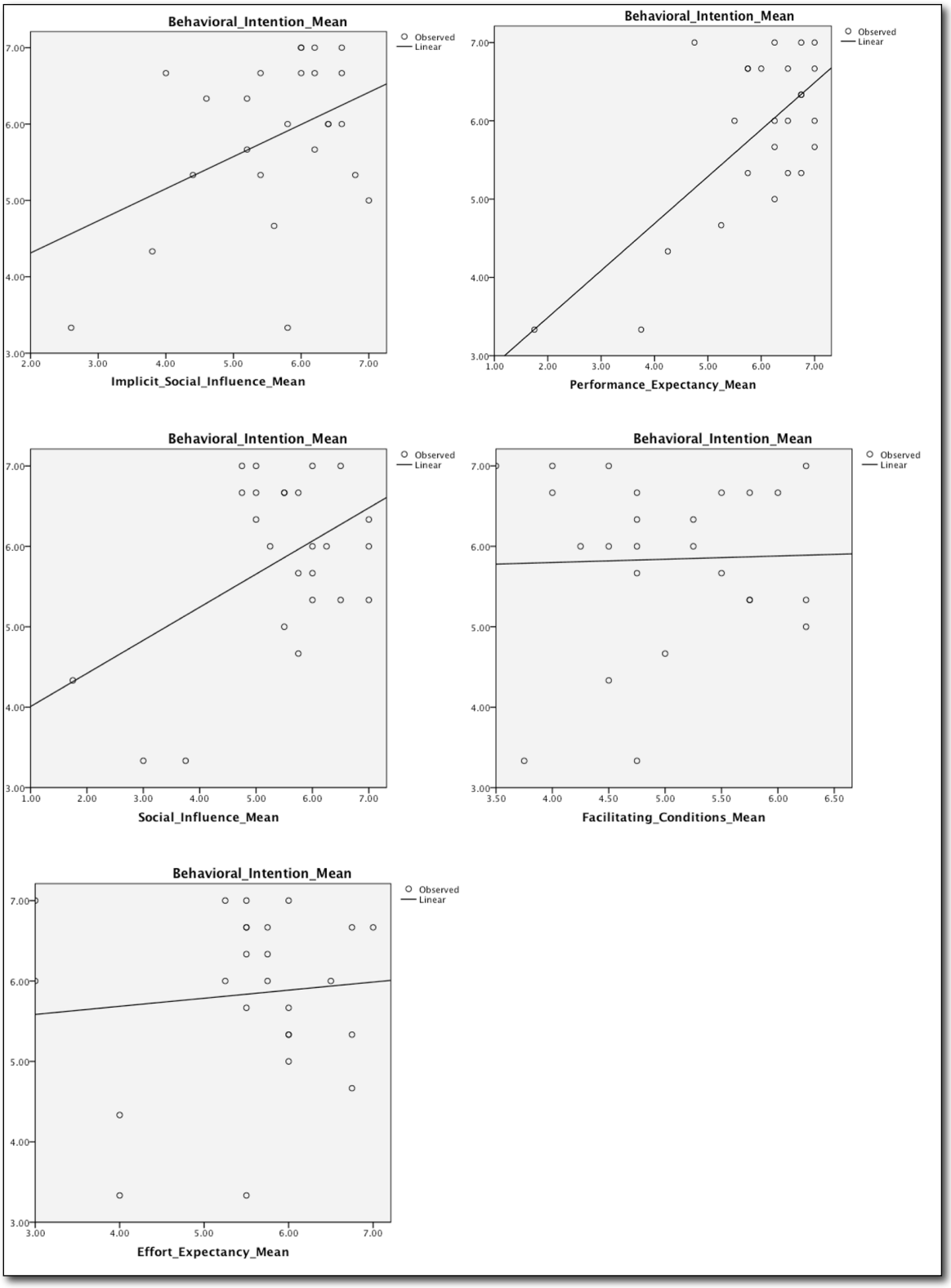


Figure 4. Curve Fit from Survey Data

Survey Analysis Summary

Beginning with internal reliability and consistency measurement using Cronbach's alpha coefficient, performance expectancy and implicit social influence were found to have strong internal consistency. Explicit social influence and effort expectancy have moderate strength, with facilitating conditions having the weakest internal consistency.

Next, correlation between the survey main constructs was tested using Pearson's correlation coefficient. This test, as well as the regression test, was limited by the sample size. Based on the data collected in this study, there was significant correlation noted for each of the constructs being tested in the survey, suggesting that all of the constructs are relevant in considering the effect of interactive technology on performance-based activity.

The regression analysis showed performance expectancy and implicit social influence as having the greatest positive effect on behavioral intention. Specifically, 55.8% of behavioral intention is attributable to performance expectancy in this research study.

Finally, curve fit was modeled looking for a best-fit linear curve to visually show the effect of each of the constructs on behavioral intention. This test used calculated means for each of the constructs and plotted data for the sample n=25. Given the limited sample size, a linear curve fit was suggested for performance expectancy, implicit social influence, and explicit social influence, with behavioral intention as the dependent variable. A curve fit was not apparent for effort expectancy and facilitating conditions, which is consistent with the Cronbach alpha scores showing lower internal consistency within those constructs.

In summary, analysis of the survey data suggest that behavioral intention by knowledge workers, as it relates to the use of interactive technology, is most affected by personal perception of performance expectancy, measured by gains in personal performance. Behavioral intention is also strongly affected by social influence, implicit and explicit, manifest in the workplace culture and environment. Effort expectancy also plays a role in behavioral intention in that ease of use and time to learn new interactive technologies must be balanced by the benefits gained. There was a strong correlation between facilitating conditions and effort expectancy suggesting that to have an effect on behavior, interactive technologies must be available, integrated with workflow, and supported in the environment. However, this is speculative given the low internal reliability and consistency measured in the facilitating conditions construct for the sample tested.

Interview Data Management

Interview Process Description

In-depth interviews for this research study were conducted between January 12, and January 28, 2011. Interviews were arranged in-person, by phone, and via email. All interviews were scheduled in advance using Microsoft Outlook, which is the enterprise calendar application used across all company locations. An appointment time of one hour was blocked on each participant's calendar to conduct the interview within, as specified in the research information sheet (Appendix A). At the beginning of each interview, the research information sheet was reviewed with the participant, with respect to confidentiality and how the information shared would be used. All twenty interviews were conducted during company work hours. While this took time away from other work activities, participants willingly took part in the process and were given as much time as needed to respond to each of the questions. The company allowed its employees to bill their time, for activities related to this research study, to an internal administrative job number since all employees are required to account for 100% of their time at work. The actual time spent in each interview varied between twenty-eight and fifty-seven minutes, with the average time per interview lasting thirty-six minutes.

The locations for the interviews varied. For Loc1, six of the interviews were conducted in the participants' offices. The remaining four interviews were conducted using a vacant office. I travelled to Loc2 to conduct as many interviews as possible by meeting in-person with the interviewee. Within Loc2, three of the interviews were conducted in the participants' offices. Five of the interviews were conducted in an outer atrium located on the premises for Loc2.

The remaining two interviews for Loc2 were conducted by phone since the participants were traveling during the time I visited their office location. All interview locations were selected to ensure confidentiality of the information being shared, to provide a sense of privacy for the interviewee, and to provide an environment in which the interviewee could feel comfortable sharing his or her perspectives on the questions being asked.

Interview Materials

I entered each interview with the same three items: a printed copy of the interview guide (Appendix C), a small digital audio recorder, and an iPad® tablet computer. I referred to the guide during each interview to maintain sequencing and consistency in the way that the questions were asked. The interview guide was not given to the interviewee. Before proceeding with each interview, I gained permission from each participant to record the interview. None of the participants objected to the use of an audio recording device. I explained to each participant that the iPad would be used to make notes during the interview for further analysis and review.

Research Database

The research database was created at the beginning of the data collection process using Filemaker Pro Advanced. The database was initially used for capturing and organizing data from the surveys. This provided a source of data extracts for SPSS to complete the analysis of the behavioral intention component of this research study discussed earlier in this chapter. The database was subsequently expanded to capture, organize, and enable initial category determination for the interview data analysis.

Additional Data Sources

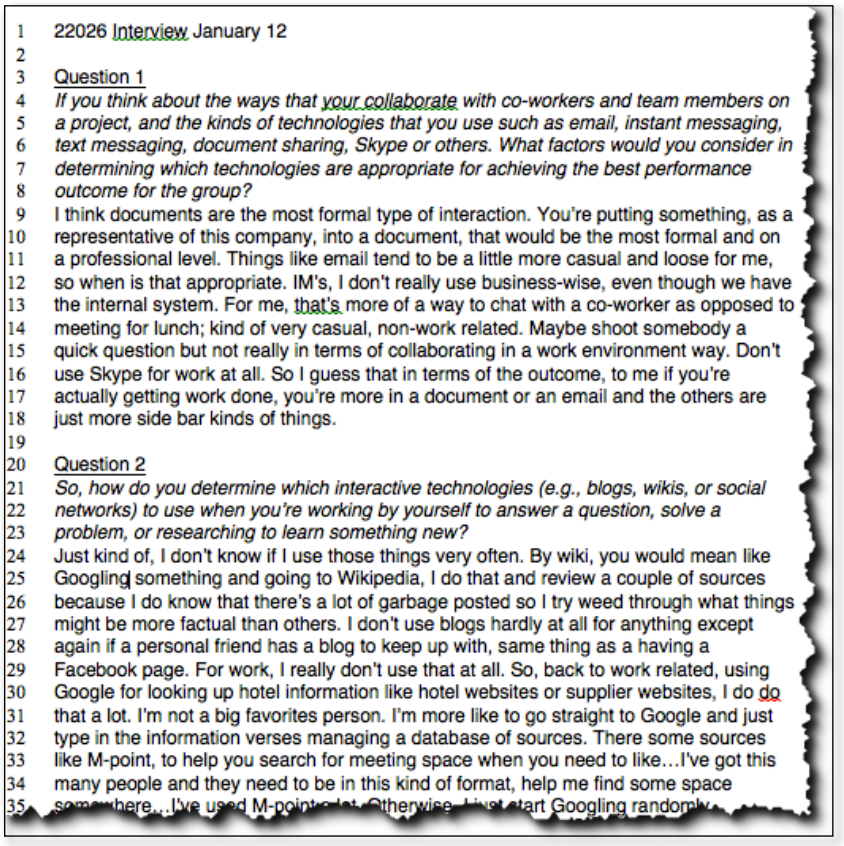
Copies of all interview transcripts in MS Word format were retained, along with verbatim comments, and stored in the research database. Field notes from each interview were catalogued by the date of the interview and the code assigned to the interviewee. To provide a complete audit trail for the research study, a research journal was maintained throughout the data collection and early analysis period that included sections for 1) daily schedule and logistics of the study, 2) a personal diary for reflexive observation and early insights, and 3) a methodological log in which methodological decisions and accompanying rationales were recorded.

Interview Data Encoding

Each interview was transcribed within forty-eight hours after the interview. Replaying the audio recording along with review of the field notes was the first step in analysis. Audio transcripts for each interview were produced using Microsoft Word, replacing the participant's name with the same unique participant code established for encoding the survey data. The format for the interview transcripts includes line-numbering down the left-hand margin of the page to provide reference for verbatim comments used in the final research report and discussion (Chapter 5). Interviewee comments within each transcript were organized by question number as the first level of categorization. As the interview transcriptions were completed, the digital audio recordings were permanently deleted as a further protection of confidentiality. An example excerpt of an interview transcript is shown in Figure 5.

The interview transcripts were next uploaded into the research database to organize the verbatim comments for each of the twelve questions contained in

the interview guide, by participant number. An example, showing a partial view of the first four questions (NOTE: question number on left side of screen) tracked in the research database, is provided in Figure 6.



22026 Interview January 12

Question 1

If you think about the ways that your collaborate with co-workers and team members on a project, and the kinds of technologies that you use such as email, instant messaging, text messaging, document sharing, Skype or others. What factors would you consider in determining which technologies are appropriate for achieving the best performance outcome for the group?

I think documents are the most formal type of interaction. You're putting something, as a representative of this company, into a document, that would be the most formal and on a professional level. Things like email tend to be a little more casual and loose for me, so when is that appropriate. IM's, I don't really use business-wise, even though we have the internal system. For me, that's more of a way to chat with a co-worker as opposed to meeting for lunch; kind of very casual, non-work related. Maybe shoot somebody a quick question but not really in terms of collaborating in a work environment way. Don't use Skype for work at all. So I guess that in terms of the outcome, to me if you're actually getting work done, you're more in a document or an email and the others are just more side bar kinds of things.

Question 2

So, how do you determine which interactive technologies (e.g., blogs, wikis, or social networks) to use when you're working by yourself to answer a question, solve a problem, or researching to learn something new?

Just kind of, I don't know if I use those things very often. By wiki, you would mean like Googling something and going to Wikipedia, I do that and review a couple of sources because I do know that there's a lot of garbage posted so I try weed through what things might be more factual than others. I don't use blogs hardly at all for anything except again if a personal friend has a blog to keep up with, same thing as a having a Facebook page. For work, I really don't use that at all. So, back to work related, using Google for looking up hotel information like hotel websites or supplier websites, I do do that a lot. I'm not a big favorites person. I'm more like to go straight to Google and just type in the information verses managing a database of sources. There some sources like M-point, to help you search for meeting space when you need to like…I've got this many people and they need to be in this kind of format, help me find some space somewhere…I've used M-point a lot. Otherwise, I just start Googling randomly

Figure 5. Excerpted Example of Interview Transcript

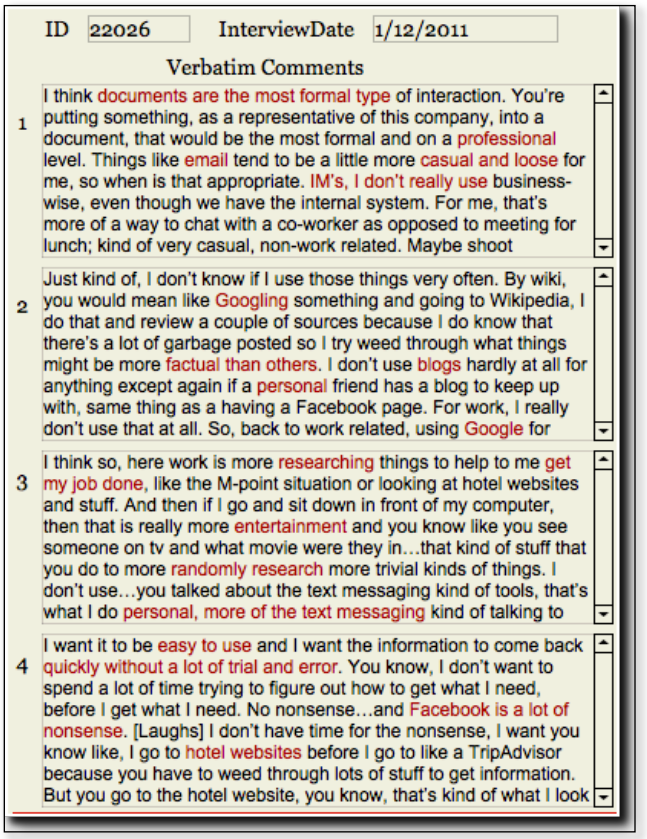


Figure 6. Database View Showing Partial View of Audio Transcription

Interview Data Analysis

Twelve questions were consistently asked during each interview in the same sequential order, providing the initial structure for organization and categorization of the data. These interview questions were derived from the five research questions posed in this study. The analysis of the interview data was primarily inductive and comparative, carried through multiple iterative stages of analysis.

Analysis Framework

A three-stage process was developed as an iterative framework for inductive analysis, to provide organization and synthesis of the significant amount of data collected. This framework encompassed initial coding and

emergence of categories from each interview, to aggregation of categories by research question, to cross case synthesis and alignment of categories with themes for the five research questions posed for this study. A graphical illustration of this framework is shown in Figure 7. Each stage of the framework supports the development and refinement of patterns based on the categories that were revealed.

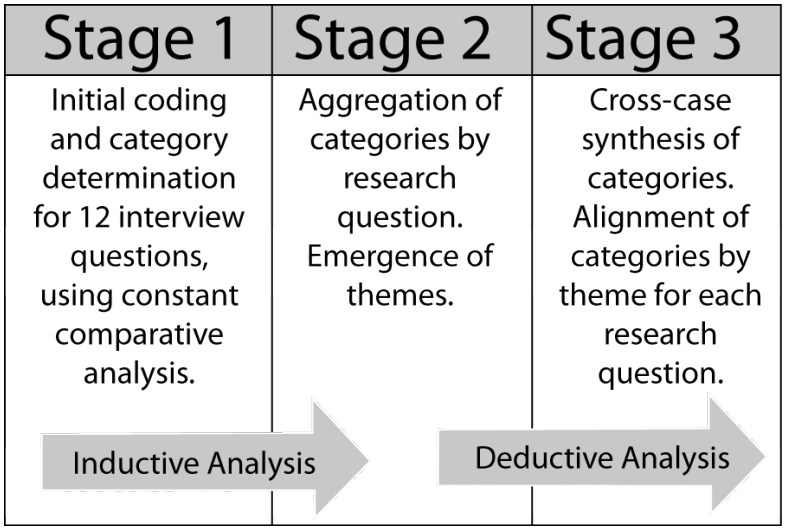


Figure 7. Analysis Framework (Source: T. Boileau)

Stage 1 Analysis

This stage provided data encoding and initial category identification. As each interview data set was entered into the research database, a unique identifier assigned to the interviewee and the interview question number provided initial coding. Beginning with the first interview, inductive analysis was applied to each question response to derive a set of categories related to the question, which were then recorded in the database. An example of preliminary categories, aligned by interview question and research question, is shown in Figure 8.

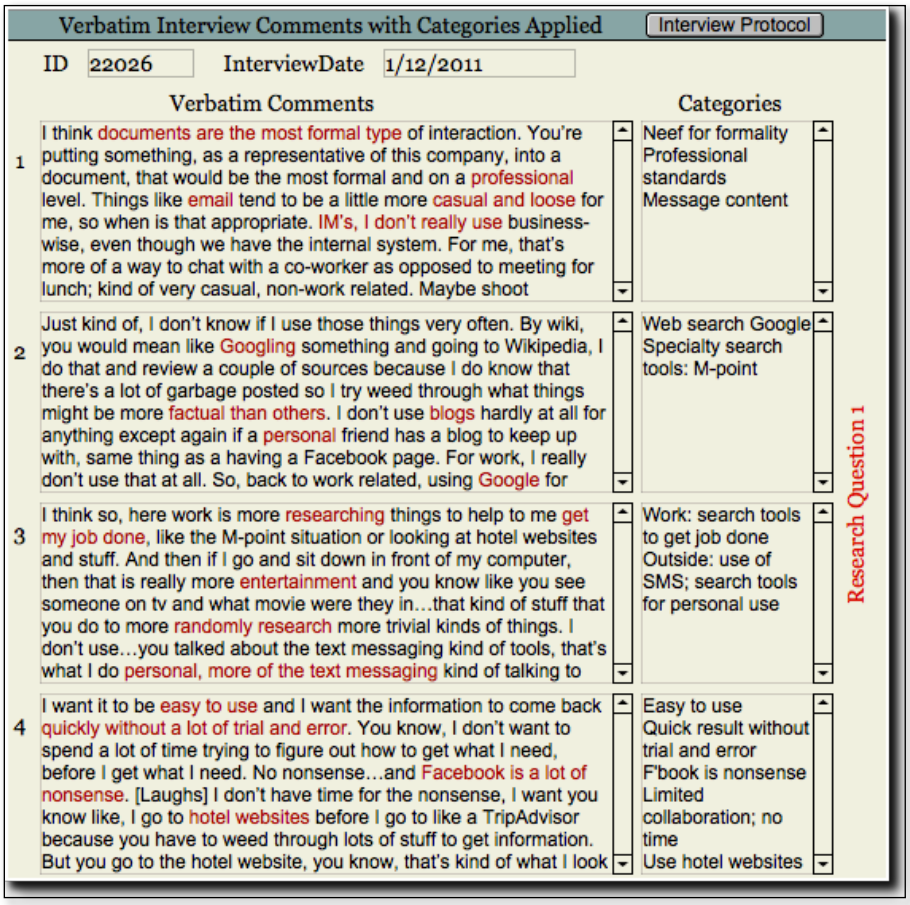


Figure 8. Database View Showing Partial View of Initial Categories

As each subsequent interview data set was added to the research database, new emerging categories were compared to the existing categories for each question using the constant comparative method (Glaser & Strauss, 1967; Patton, 2002; Merriam, 2009). These comparisons were continued throughout the data collection period with the goal of identifying specific emergent patterns in the data. Pattern matching logic was used here, and in later stages of the analysis, comparing empirically based patterns in search of coincident patterns in the case, in order to strengthen internal validity of this research study (Yin, 2009). At the end of this stage there were twenty sets of categories (corresponding to twenty interviews) for each of the twelve interview questions. A complete listing of all

categories for the twelve interview questions for each of the interviews is included in Appendix D.

Stage 2 Analysis

This stage provided integration of categories identified for each data set by synthesizing categories for each interview question. During this stage of analysis, a change in the methodology regarding treatment of the two cases was prompted based on the emergent categories ([Field Note: 27 Mar 2011]). In particular, a convergence in categories was noted for interviewees in Loc1 and Loc2 for research questions 1, 2 and 5, corresponding to interview questions 1-6, and 12. The explanation for this is that homogeneity exists within the organization, transcending geographical location for certain constructs, namely: performance expectancy, explicit social influence, implicit social influence, and effort expectancy. These constructs have been shown in this study to have an effect on knowledge workers' perceptions of behavioral intention towards interactive technology, measured by gains in personal performance. This is a key finding that is supported by the survey data analysis included in this research study. An additional finding in the survey analysis suggests that facilitating conditions, which tend to be location specific, have a minimal effect on behavioral intention as related to research questions 1, 2, and 5. The net impact of these findings at this stage of analysis is that for research questions 1, 2, and 5 (interview questions 1-6 and 12); the two location-based cases were combined for category development. For research questions 3 and 4 (interview questions 7-11) the cases were treated separately for category development in this stage of the analysis as these questions directly address cultural and social differences related to the two different geographical locations and business settings (i.e., facilitating

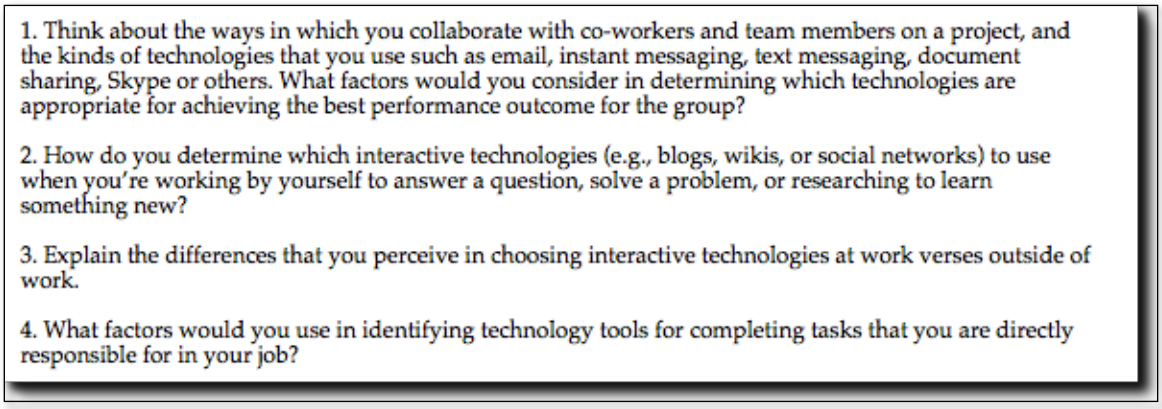
conditions) in the bounded system of the study. It is of interest, therefore, to examine categorical differences in perceptions for research questions 3 and 4 in the context of the two location-based cases at this stage of analysis. The cases are subsequently subsumed in the cross-case synthesis conducted during stage 3 of the analysis for the bounded system, rendering a holistic set of patterns identified with the five research questions posed by this study.

Research question 1. Research question 1,

> *Q1. What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?,*

asks what factors are identified by knowledge workers governing the selection and use of interactive technologies in the workplace for group vs. individual performance outcomes. The categories developed for interview questions 1-4 (Figure 9) did not indicate any differentiation based on location (Table 13) in factors used for selection of interactive technologies. Accordingly, the categories identified in this research question have been treated as a single case. Ease of use, familiarity, efficiency, performance gains, project needs, and information management and reliability were cited by the interviewees as principal factors in the selection of interactive technologies. With respect to differences in the selection of interactive technologies used for work vs. outside of work, similar methods were identified, linked to the object of the activity. In summary, effort expectancy, performance expectancy, social acceptance (explicit and implicit social influence), facilitating conditions (e.g., company provided tools, standards, and compliance requirements) and social context all emerge as principal factors

affecting behavior (behavioral intention), evidenced by the categories identified in this stage for research question 1.


1. Think about the ways in which you collaborate with co-workers and team members on a project, and the kinds of technologies that you use such as email, instant messaging, text messaging, document sharing, Skype or others. What factors would you consider in determining which technologies are appropriate for achieving the best performance outcome for the group?

2. How do you determine which interactive technologies (e.g., blogs, wikis, or social networks) to use when you're working by yourself to answer a question, solve a problem, or researching to learn something new?

3. Explain the differences that you perceive in choosing interactive technologies at work verses outside of work.

4. What factors would you use in identifying technology tools for completing tasks that you are directly responsible for in your job?

Figure 9. Interview Questions 1-4

Table 13
Research Question 1 Categories

Research Question 1			
Interview Question 1	**Interview Question 2**	**Interview Question 3**	**Interview Question 4**
Ease of use; intuitiveness	Habit and experience	Entry point in mind	Ease of use
Comfort level and familiarity	Tool access and availability	Availability of tools	Feature set
Ease of access	Ubiquitous tools; web search (e.g., Google, Bing)	Learning for fun vs. work	Familiarity with UI
Ease of adoption	Robustness of tools	Same tools and methods used in and outside of work	Comfort level
Availability 24/7	Ease of use	Similar approach to technology in and outside of work	Consistency
Access by local and remote users	Time and quickness to answer	Specialized sources may be used: industry specific vs. home shopping	Interoperability
Peer-to-peer; peer-to-client communication	Amount and depth of content	Usage of SMS and IM has risen in and outside of work	Compatibility
One-stop shopping	Conciseness of answer to question posed	Work tools (e.g., computers and smartphones) provided by company	Company provided
Security and confidentiality	Format and presentation of results	Work provides access to proprietary tools and information	Company standard

Research Question 1			
Interview Question 1	**Interview Question 2**	**Interview Question 3**	**Interview Question 4**
Shared use	Type and subject matter of information sought	Work provides company sponsored channels	Industry trends
Common platform	Reliability of information results	Work relies on colleagues, formal research group	Reliability of information
Accuracy	Social referral; recommendation of other researchers	Work requires more factual answers	Usage by peers
Speed and efficiency	Authoritativeness of source	Work is more client focused	Time to find and use technology (efficient)
Productivity	Trusted source	Work uses more project collaboration tools	Value vs. results (effective and competitive)
Frequency of use	Credibility of source; ability to cite	Work tools selected to get the job done	No particular tool or formalized system
Engagement level	Consumption ability of information by clients	Outside work more relaxed, lazy approach to technology	Role-based requirements (ex. Sales)
Training requirements	General vs. specific information needs	Outside work can be opinion-based	Task requirements
Feedback w/o redundancy	Business or industry context	Outside work more social; for entertainment	Internal vs. external audience
Accountability and auditability	Subscription-based search services	Outside work use public websites	Value vs. results
IT standards compliance	Academic database resources for research	Outside work use personal relationships for recommendations	Context and setting
Size and diversity of team / groups	Official websites	Text messaging (i.e., Skype and IM) is more accepted at work and outside	Personal intuition (knowledge of tools)
Multiple user support	Some usage of wikis, blogs, and social media sharing sites	Facebook access is ubiquitous at home and work	No implicit factors
Collaboration support	Separation between work and personal social media tools	Facebook is for social, personal networks; outside of work	
Stakeholder buy-in	Separation between primary and secondary sources	LinkedIn is for building and maintaining professional networks	
Permanence of record	Ex. blogs, Facebook for personal; LinkedIn for work	Need to separate professional from personal social networks	
Historical record	No bias in selection of sources and methods	Personal and work represent different communities	
Formality and importance of	Not proactive in adoption of	Tools that exist within the community that	

Research Question 1			
Interview Question 1	**Interview Question 2**	**Interview Question 3**	**Interview Question 4**
message	technology tools	are free and make sense	
Live-virtual review of information	Wikipedia; community based and curated information	With mobile, always on the Internet	
Client-directed usage of tool			
Client interaction			
Project needs and complexity			
Value and benefit of results to company			

Research question 2. Research question 2,

Q2. What are the rules for the use of interactive technology for peer-to-peer and group collaboration?,

is an inquiry into knowledge workers' perceptions of rules governing the use of interactive technology in peer-to-peer and group collaboration, expressed in interview questions 5-6 (Figure 10). Here again, there was no differentiation of categories based on location, providing a single case for analysis in this stage. Interviewees in both locations stated that they were not aware of any explicit rules in place restricting the use of interactive technologies in the workplace (Table 14). Business efficacy, information security, and interpersonal relationships combine to suggest a set of implicit rules for the use of interactive technology for collaboration. Performance expectancy and social influence (implicit and explicit) are the principal factors affecting behavioral intention, based on the categories reviewed in this stage for research question 2.

5. Think about the different collaborative technology tools that you can access at work such as text messaging, co-authoring a document, or being part of conversation on LinkedIn. What kinds of workgroup rules (formal or informal) are in place covering the use of these tools, when you are working with a teammate on a project or other shared task?

6. How are these rules different when you're working on a team or group activity?

Figure 10. Interview Questions 5-6

Table 14
Research Question 2 Categories

Research Question 2	
Interview Question 5	**Interview Question 6**
Rules have not been explicitly defined (8)	No rules (2)
Rules create barriers	Rules are the same for group as P2P (6)
Familiarity with tool	Same rules for conduct and behavior apply
Social setting	More personalities; need for leadership
Personal responsibility and accountability	Rules for group more explicit; formal
Business etiquette	Group interaction is more formal
Professional communication in email	Group rules and expectations set in advance
Expectations of peers	Central decision making authority
Company rules governing media access	Group access to tools and information
Focus on work needs [tasks]	Group adapts to style of members
Proprietary information usage	Individual barriers to technology extend to group
Formality with clients	Comfort level of group with technology
Client authorization for information access	More difficult to share and provide feedback
Permission for use of web video	Groups more formal; less personal
Confidentiality of data	Need protocol and guidelines for email and IM
Compliance with information security guidelines	Advance notice of technology usage
Member access control	Knowledge and comfort level for tool by members
Document retention guidelines	Greater need for document management
Political correctness and proper business tone	Rules for how often to meet as a group
Version control of shared artifacts	Rules for adding other technologies
Change tracking in shared artifacts	
Interaction and participation based on role	
Group acceptance becomes the norm	
Use whatever you have to get the job done	
Use resources provided to get the job done	
Work documents on work computers	

Research question 3. Research question 3,

Q3. How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?,

examines the perceived effect of group affiliation on technology access and performance expectancy using interview questions 7-9 (Figure 11). A divergence in categories was noted for research question 3 related to cultural, organizational and geographical effects on personal performance that are directly attributable to location. For this reason, categories were grouped for the two cases using the identifiers: Loc1 and Loc2. This schema was applied to interview questions 7-9, in order to place focus on the differences between the two location-based cases (Table 15).

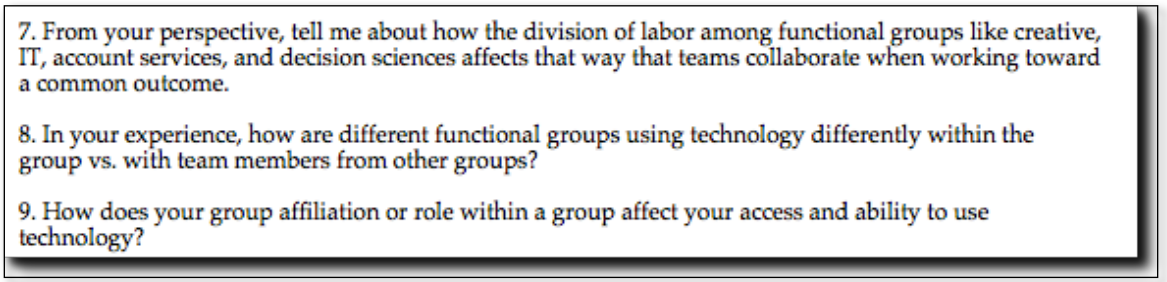
Within Loc1, group membership is grounded in communities of practice. Groups exhibit rules for behavior, social norms, and practices shared by all members, which do not extend to colleagues outside of the group. Group membership provides a social context and identity for members of the group. Group affiliation provides a sense of comfort, familiarity and status for group members, while at the same time makes communication and participation more difficult in performance activities requiring cross-functional (i.e., cross-group) team collaboration. An additional level of complexity, expressed by interviewees in Loc1, is added when working with groups in Loc2 due to differences in group norms, practice, and information management. Certain technologies are associated with particular groups, and groups may influence other groups in the adoption of new technologies. Knowledge development tends to be contained within the group, with each group managing its own repository for shared

knowledge. Group membership determines access to certain interactive technologies; however, there are minimal differences in access based on role within the group. Factors affecting behavioral intention are performance expectancy, effort expectancy and implicit social, based on the categories developed for research question 3, specific to the case identified for Loc1.

Within Loc2, groups are more formally established with increased emphasis on hierarchical structures for defining roles within the group. Within this organizational view of groups, membership is defined more by the technology tools used by members of the group, and less by social connection. As a result, the technology tools impart status for the members of the group. Tool selection and usage patterns differ among groups, making collaboration between groups problematic. The resulting effect on performance is that an artifact produced by members of one group must be reinterpreted or duplicated using different tools, in order to be used by another group. Multiple iterations are frequently needed, requiring extra time and resources to achieve a common performance outcome. Similar to the case bounded by Loc1, access to technology is defined by group and task related needs, and not by role within the group. Factors affecting behavioral intention are explicit social influence and facilitating conditions (specific to location), based on the categories developed for research question 3, specific to the case identified for Loc2.

Within each of the two locations, there is a knowledge gap between groups about what other groups are doing with regards to technology. In each location, one group is perceived to have greater freedom, with an implied expectation, to seek out and adopt new technology tools. In Loc1, the IT group is perceived to have more freedom in the selection of technology tools. In Loc2, the

Creative group is perceived to have more freedom to innovate with new technologies, while IT is perceived as being constrained by security and interoperability requirements.


7. From your perspective, tell me about how the division of labor among functional groups like creative, IT, account services, and decision sciences affects that way that teams collaborate when working toward a common outcome.

8. In your experience, how are different functional groups using technology differently within the group vs. with team members from other groups?

9. How does your group affiliation or role within a group affect your access and ability to use technology?

Figure 11. Interview Questions 7-9

Table 15
Research Question 3 Categories

Research Question 3		
Interview Question 7	**Interview Question 8**	**Interview Question 9**
Loc1	***Loc1***	***Loc1***
Groups have their own structure or 'tribe'	Don't know what other groups are doing (3)	Do not perceive any restrictions (3)
Groups have their own social rules	Differences in comfort level with technology between groups	Individual ability, experience and comfort level
Groups provide comfort zones for its members; stay within the zone	IT more apt to tinker with new tools	Group limits or expands access e.g., IT more; CS less access
Groups have their own rules of engagement	IT more diverse in technology tools	Equal access within role
Groups have their own rules for interaction within and outside of group	IT standards for development tools	Access based on need (not role); tools to do the job
Groups have different rules for media usage	Different tools within group vs. other groups	Access based on what's available within company
Groups require more management within and across	Group preference drives tool selection	Access based on client/program requirements (not role)
Groups have different work practices	Knowledge sharing tools add benefit e.g., Basecamp	Expectation of IT role to be proactive with new technology recommendations
Groups embrace different tools based on preference and needs	Groups have separate document repositories	New members of IT team get older computers
Groups influence other groups affecting practice	Communication challenges with different technologies	Some tools limited by, or specific to role i.e.,

Research Question 3		
Interview Question 7	**Interview Question 8**	**Interview Question 9**
among the larger community	among groups	SalesForce
Group silos change work dynamic and effectiveness of cross-group teams	Groups have different technologies and norms for usage	Company encourages new tools, ways of doing business
Working across groups increases complexity for a project	Collaboration is simpler within the group; fewer errors	Leadership role expected to have greater 24/7 access e.g., Blackberry
Working across groups is more challenging	Groups have established systems and practices used by members	Same access to tools at work or at home
Working across groups requires role awareness and role expectations	Collaborating with members outside of group is more complicated	***Loc2***
Too many groups; confusion about responsibility and accountability	Collaborating with members outside of group requires more follow-up	Same access for all members of group (2)
Business rules dictate interaction between groups to find common ground	Technology tools based on function of group; job specific	Access not universal
Project teams outside of groups are most effective	Technology tied to strengths of group	Common access to email
Project teams dissolve when members retreat to groups	Cross group collaboration via common email platform	Permissions based on role
Relationships with members of other groups builds trust	Mobile technology used with groups; always connected	IT takes more liberties in trying new technologies
Know strengths and weaknesses of group members	Greater difference working with groups in LOC2	Access depends on activity
Takes time to learn personality types and communication styles	Groups within same location (Loc1) use similar methods and tools	Clients require proprietary technology
Working with other groups requires higher frequency of contact to affect action	Technology tools are indigenous to business units	Managers can expense more mobile
Tool differences affects cross-communication between groups	Knowledge and methodologies stay with group; outputs are shared	Company not leveraging technology; not a priority
Loc2	Limited opportunities to learn about technologies used by other groups	Access to technology based on need, not role
Groups have their own favorite collaboration tools	Technology barriers created by groups; overcome by individuals	Access based on individual decision to use tool
Creative group using social project management tool i.e., Basecamp (emphasis on interactions)	***Loc2***	Use of tools provided by company
IT group using content management tool i.e., SharePoint (emphasis on	Don't know what other groups are doing (2)	No rules for personal selection of technology

Research Question 3		
Interview Question 7	**Interview Question 8**	**Interview Question 9**
artifacts)		
No integration between group collaboration tools; duplication of effort and data	Creative has more freedom than IT	
Group tool differences magnify restrictions on inter-group collaboration	IT constrained by security and architecture compliance	
Groups use different tools to solve the same problem (i.e., Basecamp vs. Sharepoint)	Differences among groups linked to technologies	
Common, but least collaborative, organizational tools: email, SMS, phone	Group dynamics and layout affect technology choices	
Senior executives use least amount of collaboration tools i.e., email with no common repository	Tools provide faster communication with the group	
Groups have too many layers, workflows are convoluted in excessive layers	Groups are siloed in terms of technologies	
Groups have too many handoffs; no direct task ownership	Groups have autonomy in technology selections	
Creative group uses more social media	Within project teams, more IM i.e., informal communication	
There is a need for more collaborative tools	Across teams, more reliance on email i.e., formal communication	
Multiple group hub i.e., SharePoint document repositories, do not cross group boundaries	No collaboration or common vision across teams	
Knowledge of tools varies by group	Loss of control over outcomes from other groups	
Collaboration within group is easier than outside of group	Lack commitment to task from other teams	
Groups and roles within a group have access to different tools	Systems get in the way of progress	
Groups force reliance on others to do their job	You have to break the rules, circumvent systems	
Have to trust in the expertise of others to use their tools	Same tool, used differently by other groups	
Reliance on others to provide information that is usable and understandable	Tool use is dependent on role	
Focus should shift to cross-functional solutions for clients for better performance of	No protocol for collaborative tool usage	

Research Question 3		
Interview Question 7	**Interview Question 8**	**Interview Question 9**
groups		
	Focus needs to shift toward technologies for collaboration e.g., Basecamp	

Research question 4. Research question 4,

Q4. How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?,

examines the effect of cultural and geographical differences on rules governing the use of interactive technology in activity-based performance, as expressed in interview questions 10-11 (Figure 12). Category analysis for research question 4, as with research question 3, reflected divergence in the two cases, related to cultural and social effects on personal and team performance, that is attributable to geographical location. Because of this distinction, categories identified for interview questions 10-11 were grouped by Loc1 and Loc2, bringing focus to the differences between the two location-based cases (Table 16) during this stage of analysis.

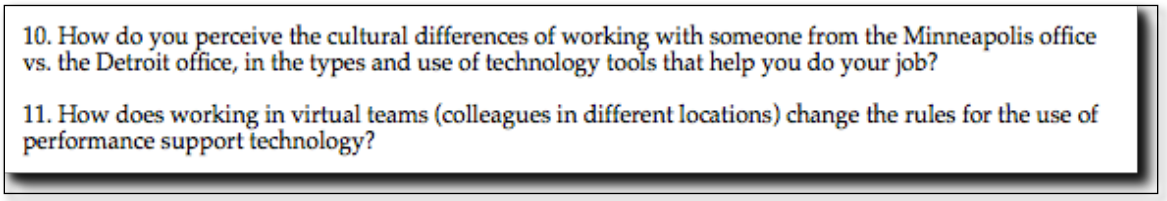
Within Loc1, social structures are perceived as less formal than in Loc2. Technology tools are perceived to be more advanced and easier to obtain in Loc2 than in Loc1. Working with colleagues in Loc2 requires more frequent and greater formality in communication, and response times are slower than when working with colleagues in Loc1 due to time zone and location differences, regardless of the technology used. Collaboration on artifacts is more difficult with colleagues in Loc2 because there are separate document repositories and different processes in place. Interviewees in Loc1 did not perceive a difference in

rules governing the use of interactive technologies when working in virtual teams. There is, however, a greater reliance on technology tools by virtual team members. In some ways, interactive technology tools improve communication among virtual team members as all members adopt the same methods of collaboration. Building trust and relationships between virtual team members takes more time and effort, than building working relationships with colleagues in the same location. Factors affecting behavioral intention are implicit social influence, effort expectancy and performance expectancy, based on the categories developed for research question 4, specific to the case identified for Loc1.

Within Loc2, there is less of a perceived cultural difference, and more individual preference, affecting the use of technology tools, when working with colleagues in Loc1. The differences that do exist appear to be overshadowed by the perception of added levels of bureaucracy within Loc2, leading to greater separation between groups. Interviewees in Loc2 perceive colleagues and groups in Loc1 as being more nimble and advanced in the use of technology tools. Additionally, the community represented by Loc1 was perceived by interviewees in Loc2 as being less encumbered by organizational governance, and more innovative in the use of interactive technologies. There is also a perception by interviewees in Loc2 that Loc1 is more entrepreneurial and pragmatic in business practices requiring the use of interactive technology because of a more direct focus on performance outcomes. Interviewees in Loc2 are in alignment with Loc1 regarding increased reliance on technology tools and perceive no difference in workgroup rules for virtual teams. There are additional perceived benefits of virtual teams cited by interviewees in Loc2 including shared learning and development of best practices, greater collaboration in performance activities,

and increased communication skills, suggesting a more supportive culture in virtual communities of practice. Factors affecting behavioral intention are social influence (explicit and implicit), effort expectancy and performance expectancy, based on the categories developed for research question 4, specific to the case identified for Loc2.

Common perceptions exist in both locations with respect to interactive technology as an enabler of virtual teams. There are also categorical contradictions in perceptions held by the two locations, specific to technology leadership. In general, there are emerging patterns that are explainable by organizational and social differences between the two locations, associated with research questions 3 and 4. These are explored in greater detail in the third stage of analysis.


10. How do you perceive the cultural differences of working with someone from the Minneapolis office vs. the Detroit office, in the types and use of technology tools that help you do your job?

11. How does working in virtual teams (colleagues in different locations) change the rules for the use of performance support technology?

Figure 12. Interview Questions 10-11

Table 16
Research Question 4 Categories

Research Question 4	
Interview Question 10	**Interview Question 11**
Loc1	***Loc1***
Different social structures	No rules change or use of virtual technology (2)
Loc1 culture less structured	Increased technology usage: voice, video, text
See little or no difference in technology (2)	Rules more important for distributed teams
Loc2 has better access to technology (2)	Sharing and communication of artifacts
Loc2 has superior technology tools	Easier for virtual teams to communicate
Loc2 creative more technology literate	Virtual teams require more meetings and checkpoints
Loc1, have to ask for new technology	Need for stronger team leadership
Technology is freely shared in Loc2	More formal rules for engagement

Research Question 4	
Interview Question 10	**Interview Question 11**
Technology gap causes frustration	Common access to virtual tools and platforms
Difference in Mac vs. PC	Complete dependence on technology
iPhone users respond more quickly than Blackberry users	Forces use of technology
Communication more formal with Loc2	Have to use all available tools
More formal interactions with Loc2; less personal	More challenging than working with collocated teams
Communication easier within Loc1	Challenge to replace face-to-face interaction
Loc2 response lag in communications	Virtual technology removes time and distance barriers
Lowered expectation for response from Loc2	***Loc2***
Loc1 response more immediate	No difference in virtual teams (2)
Time difference	Greater use of interactive technology for virtual teams
More process and challenges working with Loc2	Productivity increase using video and text messaging
Different roles in Loc2 using different technologies	Time zone difference affecting synchronous communication
Separate document repositories	Technologies common to all team members
Email is common communication tool between locations	Unofficial adoption of technology tools
More phone calls needed to discuss email	End user computing affecting what can be loaded
Require greater effort to build relationships with Loc2 (2)	Virtual teams lead to less interaction among members
Greater focus on building human connections	Expect remote team members to be more independent
All artifacts are digital with Loc2, no hardcopy	Loc2-based team members work closer together on details
Loc2 creative is elitist in use of technology	Working virtually across cultures increases learning
Loc1 creative are early adopters; not elitist	Virtual teams create new perspectives
Loc2	Virtual technologies enable growth and best practices
Do not see any differences (3)	Virtual teams increase collaboration and creativity
Individuals determine technology usage, not location	Virtual teams work faster, better, more collaboratively
Loc2 is more corporate, disparate focus (2)	Virtual teams more adept at using collaborative tools
Loc2 requires stricter compliance	Virtual tools for document collaboration and review
Loc2 is bigger, more departmentalized	Virtual team members need a separate skill set
Loc2 more separation between groups; less synergy	Rules for document management in virtual teams
Loc2 more general service focused	Virtual collaboration needs alignment of tools with strategy
Loc2 harder to get to decision maker; slower decisions (2)	
Loc1 more delivery focused, closer to clients	
Loc1 operates under less governance	

Research Question 4	
Interview Question 10	**Interview Question 11**
Loc1 less bureaucratic, smaller group	
Loc1 has fewer obstacles to getting work done	
Loc1 has more liberty and freedom	
Loc1 more advanced and nimble with technology (3)	
Loc1 more open-minded to change	
Loc1 more entrepreneurial and collaborative	
Loc1 more holistic view of business	
Loc1 willing to take risks with technology	
Loc1 is a more interactive space	
Easier to get things done in Loc1, fewer silos	
Loc1 easier to mobilize core skills and competencies	
Communication with other location more strained	
Emails between offices are misinterpreted more often	

Research question 5. Research question 5,

Q5. How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?,

addresses the effect of a knowledge worker's individual perception of his or her role and group affiliation on motivation to use interactive technologies to increase personal performance. This is reflected in interview question 12 (Figure 13). There was no differentiation of categories based on location, providing a single case in this stage of analysis (Table 17). Knowledge workers from both locations that were interviewed for this study perceive a strong sense of personal responsibility to stay abreast of emerging interactive technologies. Role perceptions of the interviewees include leadership through example, maintaining a competitive advantage in the market, and anxiety of being left behind others

who are more open to learn new technologies. Factors affecting behavioral intention include performance expectancy, social influence (explicit and implicit), and effort expectancy, based on the categories reviewed in this stage for research question 5.

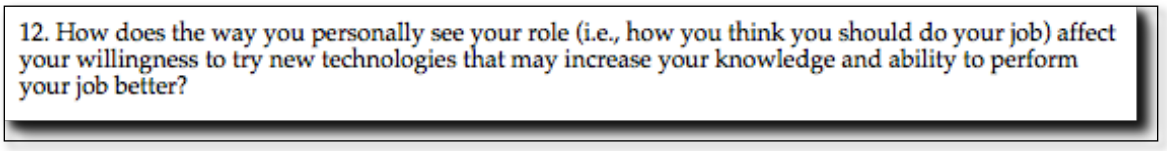

12. How does the way you personally see your role (i.e., how you think you should do your job) affect your willingness to try new technologies that may increase your knowledge and ability to perform your job better?

Figure 13. Interview Question 12

Table 17
Research Question 5 Categories

Research Question 5
Interview Question 12
Need to be proactive
Outgoing with technology
Keep up or be left behind
Innovate or be forgotten
Innovation is required in role
Need to be competitive
Tools help to do the job better
Technology helps the team
Obligation to provide team with best tools
Learning new technology helps career
Value in doing a good job
Lead in advocacy of technology
Assimilation of technology by example
Informed opinion and advocacy
Inspire team to use new tools
Expected to support technology
Influenced by what is happening in industry
Willing to try new things
Keep up with current trends for advancement
Continuous learning
Learning technology is fun
Perception of role does not limit desire to learn
Expectation to try things not tied to role
Obligation to try new technology based on role
Learning technology provides growth and improvement
Learning technology increases collaboration
Stay ahead of clients
Finding new solutions for clients
Customer expectations for new ideas
Technology must add value; efficiency and effectiveness

Research Question 5
Interview Question 12
Avoid bleeding edge, technology must be stable
Build client credibility
Fun in learning new things
Must be quick to learn; limited time to learn
Technology should have familiar interface
Find time to make innovation a priority
Personal motivation to learn new technology
Anxiety in not understanding technology
Do not seek out technology, but enjoy using it
Not allowed to install new software
Only adopt and use technology provided by company

Stage 3 Analysis

The process of constructing categories that began in stage one with the data encoding process, continued through stage two, by employing a highly inductive process of analysis. At the end of stage two, an exhaustive list of categories was created, which were aligned with the research questions posed by this study, using the interview questions that were asked. A clear set of patterns became visible, using deductive analysis. These patterns are in alignment with the themes represented by the five constructs developed for the survey analysis, shown to affect behavioral intention, namely: performance expectancy; effort expectancy; explicit social influence; facilitating conditions; and implicit social influence. These themes comprise a final set of mutually exclusive, empirically derived categories encompassing the twelve interview questions, thereby providing necessary context to answer the research questions asked by this study. In this final stage of analysis, these themes have been applied to the central research questions, extending the deductive analysis with appropriate support from the empirical data, thus completing the interview analysis. In addition, cross-case synthesis was applied to research questions 3 and 4,

providing a single case for the bounded system of interest in this research study. Table 18, located at the end of this section, provides a summary of the research themes and categories, aligned with the five research questions.

Research Question 1. Research question 1 examined the relationship between knowledge workers and some activity/object that is mediated by interactive technology tools. This is one of three key relationships in the activity theory model developed by Engeström (1987), which provides a grounding theoretical construct for this study. In the context of this research study, an activity represents an informal learning activity, which is sub-classified into actions and operations, and the object represents the top-level performance goal for the activity.

Of particular interest to this study was the development of insight for better understanding the factors used by knowledge workers in the selection of interactive technologies at the workgroup and individual level. The reason for this is that interactive technologies (Web and mobile) provided by the social Web (also referred to as Web 2.0) have become ubiquitous and embedded in the professional and personal lives of knowledge workers, often with little separation between the two. *The first insight gained in this analysis is that context and social setting affect knowledge workers' perceptions of when, where, and with whom, it is appropriate to use interactive technologies in operations, actions, and activity-based performance related to a top-level performance goal.* This is very different from; a woodworker, an assembly line worker, or a technician, who have a prescribed set of tools that are largely defined by the activity.

The set of themes that are linked with research question 1 are:

- Performance expectancy
- Effort expectancy
- Explicit social influence
- Implicit social influence
- Facilitating conditions

Each of these themes was shown to have an effect on behavioral intention and is discussed briefly here with support from the empirical data. Performance expectancy is the perceived value of using a technology tool, or how much the tool will add to job performance. Categories in this question related to performance expectancy include: quickness to answer; compatibility and interoperability with other systems; productivity; value and credibility of results; accuracy and reliability; and knowledge creation.

Effort expectancy refers to ease of use or effort required to use a technology tool to perform an activity. Categories in this question related to effort expectancy include: ease of use; ease of access; easy to learn; experience and familiarity with tool; comfort level; speed and efficiency.

Explicit social influence is the degree to which a knowledge worker perceives that other people, in positions of authority, believe that he or she should use the interactive technology. In other words, it is the perceived affect of organizational leadership on behavioral intention to use certain interactive technologies. Categories in this question related to explicit social influence include: security and confidentiality; company standards; legal documentation requirements; format and presentation of results; inter-group cooperation; accountability and auditability.

Implicit social influence is the degree to which knowledge workers' social connections influence the way that he or she uses interactive technology. In this study, implicit social influence was perceived in peer-to-peer connections with a distinction between work and personal community membership, affecting behavioral intention for the use of interactive technologies based on social setting. Categories related to implicit social influence in this question include: support from community; shared use; increased use of SMS and IM in and outside of work; engagement level; collaboration support; used by peers; trusted source; separate business and personal communities.

Facilitating conditions refer to the degree to which a knowledge worker believes that the organizational infrastructure supports the use of interactive technologies. Survey data analysis showed high correlation between facilitating conditions and effort expectancy, however, there was not significant correlation between facilitating conditions and behavioral intention to use interactive technologies. This suggests that facilitating conditions are less of a factor for predicting behavioral intention when factors related to performance and effort expectancy are present. Knowledge workers in this study all have access to computers, the Web, and to smartphones (for email and text messaging) inside and outside of work. Categories related to facilitating conditions include: availability of tools 24/7; company provided resources; company sponsored channels; same tools and methods used in and outside of work; free tools; and common platforms.

Research Question 2. Research question 2 examined the relationship between knowledge worker and community (i.e., peers, colleagues, and co-workers) that is mediated by a set of rules affecting the use of interactive

technologies. Rules in this context could imply business/work rules, client obligations, standards, regulations, policies, and procedures. This is the second key relationship in the activity theory model developed by Engeström (1987), which provides a grounding theoretical construct for this study.

This research question was intended to provide insight to rules affecting the use of interactive technologies by knowledge workers. Rules are often perceived by knowledge workers as prohibitions on behavior or as a restriction on the use of certain interactive technologies. The research setting for this study provides open access to knowledge workers to most areas of the Web including social networking sites and other forms of social media. *The second insight gained in this analysis is that the majority of knowledge workers who participated in this study do not feel encumbered by formal rules restricting the use of interactive technologies in performing their jobs, yet cultural and social rules directly impact performance.* Indeed, fifty percent of the participants stated that they were not aware of any rules regarding interactive technology use in peer-to-peer workgroup collaboration, while thirty percent stated there were no differences in rules for group collaboration.

The set of themes that are linked with research question 2, found to have an effect on behavioral intention are:

- Performance expectancy
- Explicit social influence
- Implicit social influence

The definition of performance expectancy is the perceived value of using a technology tool, or how much the tool will add to job performance. In the context

of research question 2, the focus was on how rules affect perceptions of performance expectancy, and behavioral intention. Categories related to performance expectancy include: personal responsibility and accountability; focus on tasks; access restriction; document and version control; change management; use resources provided to get the job done; and rules for adding other technologies.

Explicit social influence in this question is the perceived influence of rules imposed by organizational leadership, in turn affecting behavioral intention towards the use certain interactive technologies. Categories in this question related to explicit social influence include: rules create barriers; formality in communication; data confidentiality and security; political correctness and proper tone; central decision making authority; and advance notice of technology usage.

Implicit social influence, in the context of research question 2, is the affect of rules in forming social connections and associated influence on behavioral intention for interactive technology. This theme provides direct application of the activity theory model, by presenting evidence of the mediating affect of rules in the relationship between knowledge workers and communities of practice, in this study. Categories related to implicit social influence include: social setting; business etiquette; group acceptance becomes the norm; expectations of peers; group access to tools and information; group adapts to styles of members; groups more formal, less personal; and group rules set in advance.

Research Question 3. Research question 3 examined the mediating effect of division of labor (group assignment and usage patterns of technology) on collaborative activity and related performance outcomes for the community. This

is the third key relationship in the activity theory model developed by Engeström (1987), which serves as a grounding theoretical construct for this study. In this research question, division of labor refers to functional groups such as technology services, client services, and creative. Different roles that are subsumed by knowledge workers are aggregated into the functional groups to which workers are assigned. Communities, in this study, are formally defined by the organizational setting as one of three different business units: information technology (IT), business-to-business client services (B2B), or business-to-customer client services (B2C). Communities are also defined by location and by project teams, which form around specific performance objects. All communities are made up of knowledge workers from different functional groups with different technology preferences and usage patterns. *The third insight gained in this analysis, therefore, is that a community is reliant on inter-collaboration of functional groups; group differences in technology selection and usage patterns within groups create inconsistencies for informal learning and performance, which must be mitigated by the community for meaning making and aggregate performance to occur.* This is a significant finding because it suggests group preferences and usage patterns for technologies add to the mediating effect of division of labor on informal learning and performance of the community, as described by the activity theory model.

As discussed in stage two of the analysis, a divergence in categories was noted for research question 3 related to cultural, organizational and geographical effects on personal performance that are directly attributable to location. Themes that are linked with research question 3 in Loc1, found to have an effect on behavioral intention, are:

- Performance expectancy
- Effort expectancy
- Implicit social influence

Different themes were found for research question 3 in Loc2, which are:

- Explicit social influence
- Facilitating conditions

The difference in themes between the two cases is attributable to two primary social and cultural differences in the location of employees. First, the total number of employees in Loc2 is approximately eight hundred whereas the number of employees in Loc1 is just over a hundred. This creates smaller and more socially connected communities within Loc1 than are experienced by knowledge workers in Loc2. Second, Loc2 serves as the global corporate headquarters for the entire organization, while Loc1 is a field office. Because of this, the culture and reporting structure in Loc2 is more hierarchical and formally defined than the culture in Loc1. The effect of these differences is that group membership is grounded in communities of practice within Loc1, whilst group membership within Loc2 is defined more by technology tools, and less by social connection.

Performance expectancy is the perceived value of using a technology tool, or how much the tool will add to job performance. In this context, performance expectancy is the perceived value to the community. This theme is identified with Loc1 because of stronger social connections. Categories related to performance expectancy in research question 3 include: groups have different work practices and processes; groups embrace different tools based on

preference and needs; cross-functional teams are most effective; technology comfort level varies between groups; knowledge development stays within groups.

Effort expectancy, in the context of this question, refers to ease of access and effort required to use a technology tool in completion of an activity requiring intra- or inter-group collaboration. This theme emerged in both of the case locations; however, it is most identified with Loc1. Categories that relate to effort expectancy in research question 3 include: working across groups increases complexity; working across groups is more challenging; groups require more management within and across; collaboration within group is simpler, fewer errors; technology barriers created by groups; and different tools to solve the same problem.

Implicit social influence, in the context of research question 3, is the perceived affect of group affiliation on collaboration and performance, and the associated influence on behavioral intention for interactive technology. This theme was most recognizable in Loc1 given the stronger social connections of communities. Categories that relate to implicit social influence in this question include: groups have their own social structure and rules; group silos change work dynamic in cross-group teams; groups create confusion about responsibilities and accountability; groups influence other groups affecting community practice; and differences working with groups in other location.

Explicit social influence, in the context of research question 3, is the perceived affect of division of labor linked to organizational structure, influencing behavioral intention towards interactive technology usage in collaborative activity. The theme of explicit social influence was more prevalent

in Loc2 due to its more formalized organizational structure. Categories in this question that relate to explicit social influence include: workflows are convoluted by multiple layers in groups; common tools are least collaborative; executives use least amount of collaboration tools; limited opportunity to learn technologies used by other groups; groups given autonomy in technology selection; group technology differences create silos; and tool usage dependent on role.

Facilitating conditions, in the context of research question 3, refer to the degree to which a knowledge worker believes that the organizational infrastructure supports the use of interactive technologies for intra- and inter-group collaboration. This theme emerged in categories linked to Loc2 due to the presence of larger groups and communities than Loc1. This suggests a more centralized technology planning approach aligned by role, which is supported by a policy of autonomous technology selection by group. Categories in this question that relate to facilitating conditions include: technology access based on company provided tools; groups don't know what other groups are doing; tool access not universal by group; and no rules for personal selection of performance technologies.

Research Question 4. Research question 4 is an inquiry into the role of different social and cultural settings on the interpretation of rules affecting activity-based performance. My interpretation of the activity theory model in this research study suggests that there is an implied relationship that exists between rules and the activity/object, which is mediated by the cultural setting and social context in which the activity occurs. Because social and cultural setting is bounded by location, a divergence in categories was observed for the two case locations as discussed in stage two of this analysis. Differences in perceptions

related to interactive technology affect collaboration between the two locations, specific to performance activities and the creation of artifacts. *The fourth insight gained in this analysis is that the development of virtual communities, and corresponding use of supportive interactive technologies, serves to mitigate some of the cultural and social differences that are inherent within geographically dispersed communities. This is attributable to increased opportunity for communication, knowledge development and curation, and skills development through the formation of alternative workspaces and community-based rules for performance, which are defined by performance expectations for virtual communities of practice.*

Despite organizational and social differences between the two locations, similar themes emerged for this question based on the categories observed. The complete set of themes affecting behavioral intention in the context of research question 4 are:

- Performance expectancy (Loc1 and Loc2)
- Effort expectancy (Loc1 and Loc2)
- Explicit social influence (Loc2)
- Implicit social influence (Loc1 and Loc2)

Performance expectancy, in the context of research question 4, is related to the perceived benefit of interactive technology given different work rules based on setting. Loc1 and Loc2 represent different social and cultural settings, having similar expectations of job performance, which become blended through the formation of virtual teams. Categories related to performance expectancy in this research question include: Loc2 has superior technology tools; technology gap causes frustration; inter-office emails misinterpreted; productivity increase using

video and text messaging; working virtually across cultures increase learning and best practices; virtual teams create new perspectives; and virtual teams more adept at using collaborative tools.

Effort expectancy is the perceived effort in using interactive technologies for informal learning and performance based on work rules related to different settings and virtual teams. Effort expectancy emerged as a consistent theme in Loc1 and Loc2. Categories related to effort expectancy in research question 4 include: virtual teams force use of technology; virtual teams require more checkpoints; communication between locations more strained; easier for virtual teams to communicate; management of separate document repositories; more phone calls to discuss email; common access to virtual tools and platforms; and virtual technology removes time and distance barriers.

Explicit social influence, in the context of research question 4, is the effect of organizational expectations for the use of interactive technology in achieving a performance outcome, which are external to the immediate community or workgroup. There was stronger explicit social influence perceived in Loc2, based on observed categorical contradictions in perceptions held by the two locations, specific to technology leadership. Categories related to the theme of explicit social influence in this research question include: Loc1 culture less structured; Loc2 has better access to technology; communication more formal, less immediate between locations; Loc2 creative group more elitist in use of technology; Loc2 more corporate with disparate focus on outcomes; and expectation of remote team members to be more independent.

Implicit social influence in this research question is the degree to which social connections influence rules governing the use of interactive technology in

different social settings. The theme of implicit social influence was found in the categories for Loc1 and Loc2. Categories related to implicit social influence include: greater focus on building human connections; technology choice is by individual, not location; rules more important for distributed teams; virtual teams make greater use of interactive technologies; technologies common to all team members; and virtual teams have increased sharing of artifacts.

Research Question 5. Research question 5 examines the effect of a knowledge worker's personal perception of his or her role on behavioral intention to use new technologies that provide opportunities for informal learning and continuous performance improvement. This question is based on my interpretation of the activity theory model, suggesting an implied relationship between the division of labor and a knowledge worker, which is mediated by the worker's perception of his or her role. *The fifth insight gained in this analysis is that knowledge workers in this study perceive in their role a strong sense of personal responsibility to stay abreast of emerging interactive technologies. These role perceptions include: leadership through example, maintaining a competitive advantage for their skills in the marketplace, and fear of being left behind by others who are more open to learning about new technologies*. There was no differentiation in categories, based on location, observed for this research question; therefore, the categories identified were treated as a single case. Themes that were linked with research question 5, as having influence on behavioral intention, are:

- Performance expectancy
- Effort expectancy
- Explicit social influence

- Implicit social influence

Performance expectancy, in the context of research question 5, is the value that a knowledge worker perceives in using interactive technology for maintaining and improving job performance, based on his or her perception of role within the organization. Categories supporting the theme of performance expectancy in this research question include: need to be proactive and outgoing with technology; innovation required in role; learning new technology helps career; technology supports continuous learning; technology increases collaboration; and anxiety in not understanding new technology.

Effort expectancy in research question 5 addresses how easy it is for a knowledge worker to stay abreast of new interactive technologies. Categories supporting the theme of effort expectancy in this research question include: tools help to do the job better; learning technology is fun; must be quick to learn given limited time; and technology should have a familiar user interface.

Explicit social influence in research question 5 is the perceived influence of the organizational leadership on a knowledge worker's personal commitment toward learning about and adopting new interactive technologies, based on their perception of role. Categories supporting the theme of explicit social influence in this research question include: keep up or be left behind; need to be competitive; lead in advocacy of technology; stay ahead and provide new solutions for clients; and company must approve of new software.

Implicit social influence, in the context of research question 5, refers to the degree to which a knowledge worker's social connections influence his or her behavioral intentions toward learning about new technologies, which will benefit

the community. Categories supporting the theme of implicit social influence in this research question include: technology helps the team; obligation to provide team with the best tools; inspire team to use new tools through example; and find time to make innovation a priority.

The findings presented in this stage serve as the final output of the 3-stage qualitative analysis conducted using the interview data, with integration of the themes created during the survey analysis. Table 18 provides a summary of the research themes and categories, aligned with the five questions asked in this research study.

Table 18

Summary of Research Themes and Categories; aligned by Research Question

	Research Questions	Research Themes and Categories				
		Performance Expectancy	Effort Expectancy	Explicit Social Influence	Facilitating Conditions	Implicit Social Influence
1	**What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?**	• quickness to answer • compatibility and interoperability with other systems • productivity • value and credibility of results • accuracy and reliability • knowledge creation	• ease of use • ease of access • easy to learn • experience and familiarity with tool • comfort level • speed and efficiency	• security and confidentiality • company standards • legal documentation requirements • format and presentation of results • inter-group cooperation • accountability and auditability	• availability of tools 24/7 • company provided resources • company sponsored channels • same tools and methods used in and outside of work • free tools • common platforms	• support from community • shared use • increased use of SMS and IM in and outside of work • engagement level • multi-user support • collaboration support • used by peers trusted source • separate business and personal communities
2	**What are the rules for the use of interactive technology for peer-to-peer and group collaboration?**	• personal responsibility and accountability • focus on tasks • access document and version control • change management • use of resources provided to get the job done • rules for adding other technologies	N/A	• rules create barriers • formality in communication • data confidentiality and security • political correctness • central decision making authority • advance notice of technology usage	N/A	• social setting • business etiquette • group acceptance becomes the norm • expectations of peers • group access to tools and information • group adapts to styles of members • groups more formal, less personal • group rules set in advance
3	**How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?**	• groups have different work practices and processes • groups embrace different tools based on preference and role • cross-functional teams are most effective • technology comfort level varies between groups • knowledge development stays within groups	• working across groups increases complexity • working across groups is more challenging • groups require more management within and across • collaboration within group is simpler, fewer errors • technology barriers created by groups • different tools to solve the same problem	• workflows are convoluted by multiple layers in groups • common tools are least collaborative • executives use least amount of collaboration tools • limited opportunity to learn technologies used by other groups • groups given autonomy in technology selection • group technology differences create silos • tool usage dependent	• technology access based on company provided tools • groups don't know what other groups are doing • tool access not universal by group • no rules for personal selection of performance technologies	• groups have their own social structure and rules • group silos change work dynamic in cross-group teams • groups create confusion about responsibilities and accountability • groups influence other groups affecting community practice • differences working with groups in other location

Table 18 (cont.)

Summary of Research Themes and Categories; aligned by Research Question

	Research Questions	Research Themes and Categories: Performance Expectancy	Effort Expectancy	Explicit Social Influence	Facilitating Conditions	Implicit Social Influence
				on role		
4	**How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?**	• Loc2 has superior technology tools • technology gap causes frustration • inter-office emails misinterpreted • productivity increase using video and text messaging • working virtually across cultures increase learning and best practices • virtual teams create new perspectives • virtual teams more adept at using collaborative tools	• virtual teams force use of technology • virtual teams require more checkpoints • communication between locations more strained • easier for virtual teams to communicate • management of separate document repositories • more phone calls to discuss email • common access to virtual tools and platforms • virtual technology removes time and distance barriers	• Loc1 culture less structured • Loc2 has better access to technology • communication more formal, less immediate between locations • Loc2 creative group more elitist in use of technology • Loc2 more corporate with disparate focus on outcomes • expectation of remote team members to be more independent	N/A	• greater focus on building human connections • technology choice is by individual, not location • rules more important for distributed teams • virtual teams make greater use of interactive technologies • technologies common to all team members • virtual teams have increased sharing of artifacts
5	**How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?**	• need to be proactive and outgoing with technology • innovation required in role • learning new technology helps career • technology supports continuous learning • technology increases collaboration • anxiety in not understanding new technology	• tools help to do the job better • learning technology is fun • must be quick to learn given limited time • technology should have a familiar UI	• keep up or be left behind • need to be competitive • lead in advocacy of technology • stay ahead and provide new solutions for clients • company must approve of new software	N/A	• technology helps the team • obligation to provide team with the best tools • inspire team to use new tools through example • find time to make innovation a priority

Summary of Analyses

Two methods were used for collecting participant data in this research study: survey and interview. Twenty-five participants completed surveys and of those, twenty participated in in-depth interviews with ten from each location.

Survey Data Analysis

A set of statistical analyses were completed on the survey data to establish internal reliability and consistency for a set of constructs shown to have an effect on behavioral intention for the use of interactive technology. In addition to behavioral intention, the other constructs are: performance expectation, effort expectation, explicit social influence, facilitating conditions, and implicit social influence. Each of these constructs has been fully defined and tested for internal validity as they apply to this study. The conclusions reached in the survey data analysis have been summarized as:

1. Behavioral intention of knowledge workers, as it relates to the use of interactive technology, is affected most by personal perception of performance expectancy, measured by gains in personal performance.
2. Behavioral intention is strongly affected by implicit and explicit social influence, manifest in the workplace culture and environment.
3. Effort expectancy plays a role in behavioral intention in that ease of use and time to learn new interactive technologies must be balanced by the benefits gained.
4. Correlation between facilitating conditions and effort expectancy suggest that interactive technologies must be made available,

integrated with workflow, and supported in the environment, in order to have a sustained effect on behavior.

The constructs that were validated during the survey data analysis were extended during the later stages of the interview data analysis, providing mutually exclusive themes for grouping categories identified with each of the research questions. This relationship was fully illustrated in Table 18.

Interview Data Analysis

The objective of qualitative analysis is to provide answers to the research questions posed in the study. I believe that I have done this effectively using a three-stage analysis framework (Figure 7). This framework relied on inductive analysis during the first and second stages of analysis for development and refinement of categories that emerged from the interview data. Deductive analysis was applied beginning in the second stage and continuing through the third, to specifically answer the research questions that were asked. Important to this part of the analysis was the use of themes, validated during the survey data analysis, for providing mutually exclusive groupings of categories for each research question. Each research question has been answered by the identification of persistent themes with empirical data support from the categories that were observed (Table 18). This analysis has also provided additional insight into each of the research questions asked by this study:

1. The first insight gained is that context and social setting affect knowledge workers' perceptions of when, where, and with whom, it is appropriate to use interactive technologies in operations, actions, and activity-based performance related to a top-level performance object.

2. The second insight is that the majority of knowledge workers who participated in this study do not feel encumbered by formal rules restricting the use of interactive technologies in performing their jobs; yet, implicit cultural and social rules directly impact usage patterns affecting performance.
3. The third insight is that a community is reliant on inter-collaboration of functional groups; group differences in technology selection and usage patterns within groups create inconsistencies for informal learning and performance, which must be mitigated by the community for meaning making and aggregate performance to occur.
4. The fourth insight is that the development of virtual communities, and corresponding use of supportive interactive technologies, serve to mitigate some of the cultural and social differences that are inherent within geographically dispersed communities. This is attributable to increased opportunity for communication, knowledge development and curation, and skills development through the formation of alternative workspaces and community-based rules for performance, which are defined by performance expectations for virtual communities of practice.
5. The fifth insight is that knowledge workers in this study perceive in their role a strong sense of personal responsibility to stay abreast of emerging interactive technologies. These role perceptions include: leadership through example, maintaining a competitive advantage for their skills in the marketplace, and fear of being left behind by

others who are more open to learning about new technologies.

The next and final chapter in this dissertation (Chapter 5) provides discussion of the research findings that have been presented here. This serves as the final report of the conclusions of this study and implications for additional research.

Chapter 5

Discussion

The purpose of this chapter is to provide added context for this qualitative multiple case research study through a discussion of the findings as they relate to the problem statement and research questions posed, with due consideration of possible implications for the theoretical constructs referenced by this study. My principal aim is to provide the reader with a concise and introspective report of my research findings, which are fully supported by empirical evidence (presented in Chapter 4) and an ongoing review of the literature.

This chapter is organized in six sections: setting and starting point; challenges, changes, and opportunities; pivotal questions raised and addressed; answers; recommendations and evidence; and limitations and need for further research.

Setting and Starting Point

Setting and starting point for purpose of this discussion represent the entity, aim, and objective for the study. In addition, the origin of the research questions and key themes developed for organization of the research categories are reviewed in this section.

The entity of interest for this study was a sample of knowledge workers located in two separate geographical offices (in the United States) within the same company, providing two cases for analysis within a single bounded system. The central phenomenon examined in this study is that interactive technology has become ubiquitous in the personal lives of knowledge workers; yet there is inconsistency in usage patterns attributable to perceived differences in social and cultural settings that exist within the same institution. The aim of

the study was to gain a systemic view of behavioral intention related to the use of interactive technology for informal learning and performance. The objective was to develop a set of principles for considering the mediating effect of interactive technology on learning and performance, which are supported by other contemporary systems activity research.

Research shows that technology tools have a mediating effect on informal learning activities and performance outcomes. This is illustrated in the activity theory model posited by Engeström (1987). A review of Engeström's model (Chapter 1) demonstrated that there are direct mediators of behavior in a systems view of performance-based activity in addition to tools, which are work group rules and division of labor. There are additional implied mediators represented in the model shown to effect behavioral intention, which are: collaboration, culture/social context, and individual perception of role. This combined set of mediators provided the basis for the research questions asked in this study, and have been linked to other research studies covered in the literature review (Chapter 2) (Koschmann, 1996; Blanton, Simmons & Warner, 2001; Collis & Margaryan, 2004; and Nardi, 2005).

There are five categorical themes, which were fully developed and validated during the survey design (Chapter 3) and data analysis, shown to have an effect on behavioral intention towards the use of interactive technology. The complete set of themes includes: behavioral intention, performance expectancy, effort expectancy, implicit social influence, explicit social influence, and facilitating conditions (Venkatesh, Morris, Davis, F. & Davis, G., 2003; and Kim, Jahng, & Lee, 2007). These themes were instrumental in establishing mutually exclusive categories aligned with the research questions, in the final stage of the

qualitative analysis included in this study. A summary of this analysis is provided in Table 18 (Chapter 4).

Challenges, Changes, and Opportunities

Challenges, changes and opportunities in the context of this discussion apply directly to what was learned from the informants who participated in this study. This section includes a brief summary of the analysis, with direct support from interview transcripts and field notes. The discussion here is framed by the research questions that were asked in the study and the findings presented through analysis of the data, with support from other research. The section closes with a brief discussion of the current research related to collaborative learning and performance in activity systems by Engeström and others.

Mediating Effect of Tools

In order to understand the mediating effect of interactive technology tools on the relationship between knowledge workers and informal learning activities linked to performance, the first research question was an inquiry into the factors used in the selection of technology tools. The interview questions were framed to shed light on the distinction in factors for personal selection of interactive technologies verses selection at the work group level, which were found to be minimal. By this, I mean that knowledge workers will consistently turn to what they know in terms of social media tools using interactive technologies when engaged in problem solving. Several of the interviewees expressed a need to keep personal separate from business objects (e.g., Facebook for personal networking verses LinkedIn for business networking), however, the operations and actions linked to activity are identical.

Knowledge workers are continuously learning while solving new and novel problems in the workplace. This is typified by a situation where work is learning, and learning is work without separation between the two types of activities. Whereas I have defined informal learning (Chapter 1) in support of performance objects, the distinction between informal learning and work is intended as more for convenience in conceptualization than a description of practice.

All five of the categorical themes shown to affect behavioral intention toward the use of technology tools were evident in the data analysis for research question 1, namely, performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence. Informant 21018 stated, "I think one of the most important things is ease of use. It should be a no-brainer just to pick it up and use it. You don't need to send someone to training so we can now start collaborating as a team on a tool." (21018:9-11) Informant 21120 had this to say, "For me, I would look at the factors of: is it easy to use; does it help me do my job; is it enjoyable or not so painful to use; are the other people around me using it…" (21120:9-10). Informant 13111 tied the factors to a group performance object by stating, "Which would be easiest for the team to communicate to reach the goal of getting something either sold or executed." (13111:9-10) Each of these verbatim statements adds support to the premise that interactive technology must be intuitive and situated in the work environment without distinction between informal learning and collaborative performance activities.

Mediating Effect of Rules

The second research question examined the mediating effect of rules on the use of interactive technologies in peer-to-peer and group collaboration. Personal perception of rules guide knowledge workers' behavioral intention towards tool selection and patterns of usage. An interesting finding in this study is that half of the knowledge workers interviewed for this study did not perceive any formal rules in place governing the use of interactive technologies for informal learning and performance. Informants did, however, identify rules linked to social and cultural setting as having a direct bearing on technology usage patterns in learning and performance activity. The reason for this is that interactive technology is ubiquitous, similar types of activities are employed for learning and problem solving inside and outside of work, and there are no explicit prohibitions on the use of interactive technologies in the environment that provided the setting for this study. As a result, community norms and values expressed in the form of explicit and implicit social influence provide the rule structure for use of collaborative technologies.

The categorical themes that emerged, during the data analysis phase for research question 2, which were shown to affect behavioral intention are: performance expectancy, explicit social influence, and implicit social influence. Missing were effort expectancy and facilitating conditions. The explanation that I attribute to the absence of effort expectancy and facilitating conditions as identifiable themes in the context of research question 2 is threefold: 1.) The informants did not perceive formal rules or prohibitions on the use of interactive technologies imposed by facilitating conditions (e.g., Internet access blocking) created by the organization; 2.) Performance expectancy towards producing a

knowledge-based object outweighs effort expectancy if the outcome is perceived worthy of the effort invested; and 3.) Effort expectancy was addressed in categories of ease of use, ease of access, and easy to learn within the context of question 1.

When asked about rules for technology use in peer-to-peer collaboration, Informant 13113 responded, "I don't think there are any [rules] to be honest with you. I don't feel as though I've ever had any kind of restrictions or rules in using those technologies." (13113:57-58) Regarding rules for group collaboration, he responded, "The only difference that I would see is that if it is a team or group activity, that everyone has access to the tool or information that's being shared." (13113:62-63) Informant 22026 suggests that rules may be incongruous outside of communities of practice, "I feel like it would be left to the devices of the people that you are working with…I think there's a very blurry line and here specifically because there are so few rules I think. I would like to believe that most of the people and the colleagues that I work with and collaborate with would know when to keep things professional verses not, but I think that it happens that people may not always know when something is appropriate verses inappropriate." (22026:76-83)

My interpretation of the findings for research question 2 is that the organization, representing the bounded system of interest in this study, provides considerable latitude for personal and group innovation related to interactive technologies by knowledge workers. Formal rules do exist in terms of policies for computer usage, data management, and information security. Informal rules exist to ensure that professional conduct and business etiquette is applied in peer-to-peer and group collaboration and communication, as defined within the

different communities of practice. This is consistent with the activity theory model, as it relates to the mediating effect of rules on the relationship between the worker and the community that he or she is a part of (Table 1). Informal rules, in particular, are strongly influenced by the community and are based on the prevailing system of norms and values of the community. Communities represent different levels of learning activity within the organization, with their own activity systems, tied to intermediate objects of collaboration (Toiviainen, 2007).

Mediating Effect of Division of Labor

Division of labor has a mediating effect on access to interactive technologies and collaboration within and across different functional groups. The meditating effect of division of labor was examined in research question 3, in the context of the relationship between community affiliation and performance outcomes. Communities in the context of this study are internally focused and derived from functional groups such as client services, creative, and information technology. Hence, the terms group and community are used interchangeably in this discussion.

In general, social and cultural differences between the two cases affect the way groups are formed, having different effects on perceptions and use of interactive technologies. In Loc1, group membership is grounded in communities of practice that gravitate towards technology tools that best serve the needs of the community and are sometimes aligned with tools used by external clients. Within Loc2, groups are formally established using hierarchical structures to define roles and technology tools used within the group. In this organizational view of groups, the technology tools selected *for* the group, rather than social

connections within the group define membership. In Loc2, the technology tools impart status for the members of the group. In both of the cases comprising this study, communities develop their own rules for behavior, social norms, and practices shared by all members, which do not extend to colleagues outside of the community. Community membership provides a social context and identity for members of the group. Furthermore, personal affiliation with the community provides a sense of comfort, familiarity and status for members. The perception, observed in both cases, is that tool selection and usage patterns differ among groups, making collaboration between groups problematic. A key insight gained from this question is that whereas a community is reliant on inter-collaboration of functional groups; group differences in technology selection and usage patterns within groups create barriers to informal learning (i.e., knowledge sharing) and performance, which must be mitigated by the community and its members for meaning making and aggregate performance to occur. This is consistent with activity theory research, which shows that intermediate activity systems have a mediating effect on other systems existing within different communities (Engeström, Y., Engeström, R., Karkkainen, 1997).

The categorical themes that are aligned with research question 3, shown to have an effect on behavioral intention, are: performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence. Referring to the effect of formally defined groups on collaborative performance, Informant 22026 stated, "…there are so many layers it becomes convoluted…the division of labor sometimes works against the performance of getting the work done…" (22026:98, 101), and "I don't really see collaboration happening at all. I'm always trying to explain what I want the outcome to be.

Then we're trying to smash the outcome to fit with what works for them." (22026:111-113) This perception is shared by Informant 13010, "I think a lot of time since there's so many separated groups that there seems to be a lot of confusion on who is responsible for getting what done, who's responsible for communicating what out." (13010:139-141)

Informants did not sense a difference in role access to technology within a group, as typified by Informant 22122, "I don't think that I have any different access than anybody else. I don't feel that there are any restrictions on people that aren't VPs or are VPs. " (22122:152-153)

My interpretation of the findings for research question 3 is twofold. First, groups should be expected, and be given necessary latitude, to adopt appropriate tools specific to division of labor within intermediate activity systems of the group. Equal attention is needed, however, in providing support for communities of practice that transcend formal group boundaries, by recognizing the mediating effect of these intermediate activity systems in support of a top level performance object (outcome). Opportunities exist, and indeed were noted by the informants, for greater alignment between groups using social media tools (e.g., Basecamp) for communicating common goals and managing shared artifacts. In this way, functional group level activity systems, mediated by the division of labor, play a direct role in supporting and sustaining community-based knowledge development and performance. Research suggests that there are multiple intermediate levels of learning and performance activities that make up the collective activity system of the organization. These intermediate levels are based on inherent developmental contradiction, the recognition of which provides a basis for understanding how movement occurs within activity

systems, from individual action to collective activity (Hill, Capper, Wilson, Whatman, & Wong, 2007).

Mediating Effect of Cultural/Social Setting

The activity theory model, which provided a theoretical base for this research study, suggests that there is an implied relationship between rules and a performance object that is mediated by the cultural and social context in which the activity occurs. What this suggests is that rules affecting performance activity, and related technology usage patterns, are interpreted in the context of the culture and social setting that a knowledge worker finds herself in. This context is different for co-located teams verses distributed teams and virtual communities, though all three may be directed towards common performance objects. In this study, culture and social setting differ between the two locations that informants were selected from, adding emphasis to research question 4 in this study.

The question asked: how do different cultural and social settings linked to location affect the way that rules related to the use of interactive technology are interpreted in activity-based performance? My analysis revealed four categorical themes aligned with research question 4, shown to have an effect on behavioral intention: performance expectancy, effort expectancy, explicit social influence, and implicit social influence. Specific to perceptions of explicit and implicit social influence on rules, Informant 12007 responded, "…there seems to be a little more formality around interactions with folks from [Loc2] verses in [Loc1]…", (12007:87-88), and Informant 13005 added, "…in a virtual team, the rules are maybe a bit more amplified in terms of how the team engages…", (13005:124-125)

Related to perceptions of performance and effort expectancy, Informant 12006 stated, "I think that support technologies are more important as the geographies change...the ability to share and communicate with ease….", (12006:97-99). There is perceived opportunity for increasing performance-based collaboration through virtual communities, as Informant 22026 shared, "I think it's eye opening spending time with people who might come from a different culture like [Loc1]. You learn different ways to get work done. The technology that lets you be virtual teams helps us grow and learn I think." (22026:157-160)

The mediating effect of cultural/social setting on the relationship between rules and performance will continue to evolve as knowledge workers in this company engage in virtual communities, suggested by Informant 12007: "I think that it [virtual teams] increases the need for the use of them [performance support technology tools] because you're more reliant upon them. So I think it kind of forces you to use tools and technology in a way that you might not when working with teams that are co-located with you." (12007:93-96)

An important insight from this research question that was developed in Chapter 4 is that virtual communities, enabled by social technologies, may mitigate some of the cultural and social differences, which are inherent within geographically dispersed communities and also between groups in the same location. The data suggests that this is because of increased opportunity for self-expression, communication, knowledge development and curation, and skills development through the formation of alternative workspaces using community-based rules for performance.

Mediating Effect of Role Perception

The activity theory model used in this research study suggests that there is an implied relationship between division of labor/role and worker that is mediated by individual perception of role. Research question 5 asked each informant: how does the way you personally see your role (i.e., how you think you should do your job) affect your willingness to try new technologies that may increase your knowledge and ability to perform your job better? The insight gained through analysis is that knowledge workers who participated in this study, in both locations, perceive in their role a strong sense of personal responsibility to stay abreast of emerging interactive technologies. These role perceptions include: leadership through example, maintaining a competitive advantage for their skills in the marketplace, and anxiety over being left behind by others who are more open to learning about new technologies.

The categorical themes that were identified with research question 5 that were shown to affect behavioral intention are: performance expectancy, effort expectancy, explicit social influence, and implicit social influence. These themes are reflected in the informant comments:

> I love technology...I'm all for simpler, easier, faster, get more done. So, I don't believe that just because I might perceive my job as a certain thing, that I would not look at some other technology if it was going to help me get better. (22026:169-172)
>
> Well my role, I think, requires it because our customers are expecting us to bring as many new ideas to them as possible…in order to bring value, I've got to make sure that I'm always constantly looking and learning about

what is going on in the market, and bringing some of these efficiencies to my clients. (22122:195-199)

I think if the technology is going to help the team and can be introduced in a pretty simplified fashion, I see it as a benefit and something I would feel motivated to bring on board…I have an obligation to make sure that my team has the best tools in hand to get done what they need to get done. (22123:121-126)

I feel obligated to try new technologies as part of my role…the tougher the new technology, the more you want to figure out how to use it. (21120:141-142)

I feel embarrassed that at the level of technology that I do use, and I certainly would be embarrassed if I was going to have to learn and adopt some new technology…I don't know if I would ask anyone here to show me how because I would be backward or inept by doing that. (13104:190-193)

I think, again given what I do, if I want to do it well I need to be very proactive. I need to be very outgoing with regards to technology…we're kind of in this new era where if you don't keep up, you're left behind. (11101:170-175)

I think that it's gotta be part of the job for the sake of your advancement. (12115:128)

I am working with people outside of this office more and more, it seems like. So it's causing me to use and look at technology differently. (12007:103-104)

Collaborative Learning and Performance in Activity Systems

In activity theory, the concept of object is of critical importance (Leont'ev, 1978). All activity is directed towards an object. Hence the object embodies the meaning, the motive and the purpose of a collective activity system. In this study, an activity theory model was used to create a view of the mediating effect of interactive technology on collaborative learning and performance in a bounded system by examining a set of mediators for activity that coexist within the system. Learning, in this context, is seen as a fundamentally collective socio-cultural and historical creation of knowledge that transforms itself into becoming the innovative learning provision for individuals, the idea of which is based on the work of Vygotsky (1978).

Much has been written about learning activities across different levels of collaborative networks, suggesting deeper, more sustainable learning and performance is enabled through intra- and, increasingly, inter-organizational collaboration (Dansereau, 2003; Hackman, 2003). The cultural-historical activity theory (CHAT) provides a set of principles and conceptual tools to analyze different levels of learning within the activity of a network (Chaiklin, Hedegaard, & Juul Jensen, 1999). This method of analysis allows for a discussion of the vertical dimension of collaboration (i.e., within networked communities), alongside that of the horizontal dimension of collaboration (i.e., across groups) (Engeström et al., 1997; Engeström, 2003). Research shows that not only do multiple activity systems participate in shared activity related to learning and performance towards an object, but that these collaborative intersections will also spawn a variety of new activities as they evolve in increasingly networked communities (Toiviainen, 2007; p. 355).

The study of learning in networks (communities) remains a complex and evolving phenomenon requiring longitudinal analysis from multiple perspectives, which is beyond the scope of this study. What we do know from activity theory research in workplace and organizational learning is that learning is a cyclical expansive process (Toiviainen, 2007; Engeström, 1987a). "The expansive cycle begins with individual subjects questioning the accepted practice, and it gradually expands into a collective movement or institution" (Engeström, 1999). Intermediate levels (e.g., project level and product development level) are created through mediated activity and are based on developmental contradiction, providing support for different levels of collaboration on objects within the organization. An example of these expanded activity levels is shown in Table 19.

In activity theory, these developmental contradictions provide the basis for new activity system development and are manifestations of underlying structural tensions within the overall activity system. Contradictions may appear as events and actions, and in behaviors. The concept of contradiction provides a basis for understanding how movement occurs in activity systems, both from individual action to collective activity, and through the resolution of different types of contradiction within the activity system. "Contradictions can occur within the elements of an activity system (e.g., within the object), between the elements (e.g., between the object and the rules), and between different activity systems" (Hill et al., 2007; p 368).

Table 19
Expanded Levels of Learning Activity

Level of Learning Activity	Object of Collaboration	Developmental Contradiction
Organization level	The company	Short-term outcomes vs long-term outcomes
Project level	Middle-plain principles of collaboration	Company's interest vs community's interest
Product development level	Material products	Construction of trust vs construction of object
Worker level	Development of work	Managers' perspective vs workers' perspective

Acknowledgement of developmental contradiction in expanded levels of learning provides opportunity to build support for sustainable enterprise learning and performance, enabled by interactive (social) technology, by taking a bottom-up approach to social collaboration for learning and performance. This is about encouraging and supporting those individuals who want to connect with others and collaborate to work and learn together by asking:

1. How can we build on what knowledge workers are already doing, by supporting those who are already using social and collaborative approaches to learning and performance?, and
2. How can we better serve knowledge workers who would like to find out how to work and learn collaboratively, that are not already doing so now?

Pivotal Question

The fundamental problem posited at the outset of this study was to provide a systemic view that could explain why there is inconsistency in the way that interactive technology is perceived and used by knowledge workers within

the same organization, tasked with related activities that are linked to predefined performance objects. There were five research questions posed by this study that have been addressed through analysis (Table 18, Chapter 4) and a discussion of the findings in the preceding section of this chapter.

Three theoretical constructs were used to form the systemic research framework for this study: Activity Theory, Distributed Cognition, and the Behavior Engineering Model. The activity theory model developed by Engeström (1987) provided a systems view of the mediating effect of interactive technology on informal learning and performance that is situated in a particular social and cultural setting (i.e., mediated by work group rules and division of labor.) I chose this model and in particular, the set of mediators and relationships defined in the model, to frame the research questions that were asked during the interviews. What was missing from the activity theory model was a set of mutually exclusive categorical themes that could be used to facilitate analysis of the data. This was provided by research conducted by Venkatesh, Morris, Davis, F. and Davis, G. (2003); and extended by Kim, Jahng, and Lee (2007), on technology acceptance and utilization in organizations. From the research by Venkatesh et al., I was able to adapt a survey instrument that I used to validate the complete set of categorical themes: behavioral intention, performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence; used in the analysis component of this study.

The second theoretical construct applied in this study was distributed cognition. The main tenet of distributed cognition is that human knowledge and cognition are not confined to the individual. Rather, cognition is distributed by placing experiences, memories, facts, or knowledge of objects, individuals, and

tools into the environment as artifacts that are mediated by technology. Reification of knowledge is achieved through social-cultural integration, thus providing context. I believe that this construct is key to maximizing the mediating effect of interactive technology via social media and social networking (provided by Web 2.0) for enabling communities of practice and was mindful of this when designing the interview protocol.

The final construct that I considered in this study was the Behavior Engineering Model (BEM), developed by Gilbert (1996). This model was originally used as a diagnostic tool for troubleshooting sub-standard performance in organizations. Gilbert defines six factors (data, tools, incentives, motives, capacity, and knowledge) needed for worthy performance that are divided between two domains (environmental and personal). I initially developed a link between Gilbert's performance factors and the activity theory model as part of the theoretical framework for this study. During the subsequent design and analysis stages of the study, the first five factors were subsumed by the categorical themes shown to affect behavioral intention, namely: performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence. The sixth factor, knowledge, was addressed by the research questions related to collaboration for development and sharing of tacit and explicit knowledge.

This synthesis of data analysis with research theory brings us finally to the pivotal question raised by the findings presented in this study, which is:

> *How can knowledge workers in geographically and culturally distributed organizations leverage interactive technologies in socially and culturally defined business settings, in a way that transcends organizational and functional*

boundaries, and encourages personal innovation and participation, in order to promote sustainable informal learning and performance for the enterprise?

Answers

There are a number of implications suggested by this study related to practice, presented and discussed in the findings, and also for the theoretical constructs that were used. These implications are now presented in this section as policy recommendations based on the context for this study, as well as consideration for future research based on the mediators of activity as discussed in this chapter. Each of the mediators identified in the activity theory model have been listed, along with the categorical themes that were observed in each mediator, in Table 20. For each of the five mediators explored in this study, I have indicated the presence or absence (YES or NO) of the five categorical themes shown to have an effect on behavioral intention. At the conclusion of this section, I discuss the implications for further theoretical research.

Table 20
Activity Theory Model Mediators with Observed Categorical Themes

Mediators		Categorical Themes				
		Performance Expectancy	Effort Expectancy	Explicit Social Influence	Facilitating Conditions	Implicit Social Influence
1	Tools	YES	YES	YES	YES	YES
2	Rules	YES	NO	YES	NO	YES
3	Division of Labor	YES	YES	YES	YES	YES
4	Cultural/Social Setting	YES	YES	YES	NO	YES
5	Role Perception	YES	YES	YES	NO	YES

Implications for Practice

Tools. Interactive technology tools to enable social learning and collaboration are being adopted by knowledge workers on their own initiative,

rather than waiting for them to become available through the company. The mediating effect of tools on performance was observed in each of the categorical themes shown to have an effect on behavioral intention. An opportunity exists for institutionalized deployment of these types of tools (with policy oversight) within the enterprise in order to enable communities while keeping socially created proprietary content behind the corporate firewall.

Rules. There are few formal rules for mediating the relationship between knowledge workers and communities, yet informal rules exist within communities. The mediating effect of rules on group collaboration was observed in three out of the five categorical themes shown to have an effect on behavioral intention. In this environment, opportunity exists for development of inter-level collaboration enabled by interactive technologies, that acknowledges developmental contradictions for alignment of objects.

Division of labor. The division of labor was observed to have a negative effect on collaboration and knowledge sharing between functional groups, and was observed in all of the categorical themes shown to have an effect on behavioral intention. Opportunities exist for greater alignment between groups using social business tools (e.g., Basecamp) for communicating common goals and managing shared artifacts across groups. Functional groups should play a more direct role in supporting and sustaining community-based knowledge development and collaboration across intermediate activity systems within the enterprise.

Cultural/social setting. Cultural and social setting has a mediating effect on the relationship of rules to performance activity, which was observable in four out of the five themes shown to have an effect on behavioral intention. Virtual

communities, enabled by social technologies, may mitigate some of the cultural and social differences, which are inherent within geographically dispersed communities and also between groups in the same location. This is because of increased opportunity for self-expression, communication, knowledge development and curation, and skills development through the formation of alternative social workspaces moderated by community-based rules for performance. Membership in virtual communities may provide new opportunities for knowledge development in inter- as well as intra-organizational settings.

Role perception. Personal perception of role has a mediating effect on a knowledge worker's motivation to use interactive technology tools for self-directed informal learning activities to achieve a performance outcome. The affect of role perception was observable in four out of the five themes shown to have an effect on behavioral intention. There is opportunity to build support for sustainable enterprise learning and performance, enabled by interactive (social) technology, by taking a bottom-up approach to social collaboration for learning and performance. This is about encouraging and supporting those individuals who want to connect with others and collaborate to work and learn together.

Implications for Future Research

My expectation is that this study will add to the research literature for activity theory as a viable framework for conducting qualitative case study research on activity systems of knowledge workers. I am not aware of other mixed-method studies based in activity theory that have integrated categorical themes related to behavioral intention as a result of my ongoing review of the literature. I believe that the alternative research framework based on activity

theory developed for this study, summarized in Table 20, has application potential for other qualitative case studies focused on the effect of interactive technologies, rooted in social media, on collaborative learning and performance.

Recommendations and Evidence

This section provides a brief discussion of emerging trends related to the use of interactive technology as a mediator of informal learning and performance by knowledge workers, as presented by Tony Bingham and Marcia Conner (Bingham & Conner, 2010). Change in social interactive technology usage patterns is coexistent with workplace changes that were observed in this study including:

- Distributed teams and functional groups that feel disconnected.
- Intellectual capital that needs to be selectively shared among employees.
- A workforce that is already using social interactive technologies and expects to be tech enabled in the workplace.

Learning organizations in all business sectors are now embracing social media to enable social learning. Social media allows individuals and organizations to embrace the needs of changing workplace demographics and enables people of all ages to learn in ways that are comfortable and convenient for them. Social (informal) learning represents a fundamental shift in how people work. It leverages ways in which knowledge workers work today by bringing new tools into the environment that accelerate and broaden individual and organizational reach through increased interaction. (Bingham & Conner, 2010)

Social learning reframes social media from a marketing strategy to a strategy that encourages knowledge transfer and connects people in ways that are consistent with how we naturally interact. It is important to recognize that social learning is not a delivery system analogous to classroom training, mobile learning, or e-learning. Rather, it is a powerful approach to sharing and discovering a whole new array of options, some of which we may not even know we need, leading to more informed decision making and a more intimate, expansive, and dynamic understanding of the culture and context in which we work. Social learning in organizations is enabled by easy-to-use, socially focused, and commercially available tools. Web 2.0 tools move services, assets, community intelligence, and guidance closer to where they are needed; to knowledge workers seeking answers, solving problems, overcoming uncertainty, and improving how they work. Examples of Web 2.0 tools include:

- Social Webcasting for digital storytelling (video)
- Micro-sharing (microblogging) in on-line discussion forums
- Wikis for growing collective intelligence
- Instant messaging
- Searchable information repository, archived in knowledge bases
- Colleague profiles, expertise locators
- Information flows, feeds, subscriptions
- Virtual environments for project teams and communities

These tools facilitate collaboration and inform choices within and between communities of practice, by tapping into tacit and explicit knowledge from a vast, intellectually diverse set of knowledge workers. (Bingham & Conner, 2010)

As additional tools are brought into the organization, guidance is needed in the appropriate use of social media for internal and external collaboration. As observed in this study, communities develop rules for accepted use; however, these rules may not be apparent to all members of the community. Additional involvement is needed from marketing and communications, human resources, information security, and legal for the development of standards for acceptable use. The challenge is to provide open access to encourage collaborative learning and work by knowledge workers without restricting access to mediating tools. This function could be served by a technology advisory committee with voluntary participation by a cross section of knowledge workers, and appropriate governance in the form of usage standards and policy.

Limitations and Need for Further Research

There are inherent limitations to any qualitative research study, which have been discussed and addressed in the trustworthiness section of Chapter 3. It can be stated that the same features that make qualitative research methodology valuable to social science research also present limitations in its usage.

As the principal investigator, I brought an informed perspective to the inquiry process of this study by way of a career spanning more than 30 years as a knowledge worker. I have also been an employee, for the past eleven years, of the company that served as the research setting, thus providing firsthand knowledge of the environmental and social context.

An overriding concern in this qualitative research study is researcher bias in framing assumptions, interests, and perceptions. To offset the potential for bias, I remained committed to ongoing critical self-reflection by way of journaling and dialogue with professional colleagues and advisors. Deliberate

controls were applied in the research design to account for bias including: triangulation of data sources, triangulation of methods, and inter-rater reliability checks with professional colleagues. A related limitation is subjectivity in that the researcher is a member of the community that provided the research setting. This limitation was also addressed by the design, particularly in the interview protocol.

Recognizing these limitations, I took the following measures. First, the research agenda and assumptions were stated up front. Coding schemes were scrutinized by my advisors and through peer reviews. To reduce the limitation of bias during data analysis, I removed all identifying information on participants, and interview transcripts were coded blindly to prevent association of data with a particular individual.

A final limitation of this qualitative research study is the limited sample size of the research design. This was addressed using a thick, rich description of the context, background, and findings that were reported in the study (Chapter 4).

Further research is needed for understanding and documenting the mediating effect of Web 2.0 interactive technologies and emerging technologies (e.g., Semantic Web 3.0) on informal learning in other organizations and learning institutions, providing broader insight to practice and policy recommendations. This could be enabled using the research design and associated constructs I have developed for this study, to serve as a qualitative research framework for future case studies involving different audience segments. The findings reported in this study may provide a baseline for such future research.

APPENDIX A: RESEARCH INFORMATION SHEET

Research Information Sheet
Title of Study: The Effect of Interactive Technology
on Informal Learning and Performance in a Social Setting

Principal Investigator (PI): Tim Boileau
Administrative and Organizational Studies
Wayne State University, Detroit, MI USA
313-333-9842

Purpose:
You are being asked to participate in a research study of technology usage patterns by knowledge workers because you engage with a variety of interactive technologies in the daily course of performing your job. This study is being conducted at [Company Name]. The estimated number of study participants to be enrolled at [Company Name] is about 30 and will be selected from the Detroit and Minneapolis offices.

In this research study, you will be asked to provide your personal perspective on the selection, application, and effect of interactive technologies (e.g., email, document sharing, and web search tools) on your personal learning. You will also be asked how interactive technologies assist you in collaborating with peers and supervisors in the performance of your job based on your role.

Study Procedures:
If you agree to take part in this research study, you will be asked to complete a survey and agree to participate in either a one-hour one-on-one interview or a thirty-minute focus group interview. You will be allowed to bill this time to an administrative project number for organizational learning.

1. If you agree to take part in this research study, you will be emailed a survey form. You will be asked to print the form and provide your response to 24 statements. It is expected that this will take no more than twenty-minutes of your time. The completed survey will then be faxed to Tim Boileau at the number provided in the survey instructions. Surveys will be sent out in January 2011.
2. If you are selected to take part in a one-on-one interview, you will be contacted to schedule a meeting time that is convenient for you. The interview will last for about an hour. Interviews may be conducted either in-person or over the phone. One-on-one interviews will take place during January and February 2011.
3. If you are selected to take part in a focus group interview, a meeting time will be scheduled to accommodate the schedules of all focus group participants. There will be five participants in the focus group and one moderator. The focus group interview will last for about thirty-minutes

and will take place via audio conference. Focus group interviews will take place in February 2011.

4. Your personal privacy will be protected and your identity will not be included in any of the data that is published in connection with this research study. You will be identified in a database for this research study by a code name or number. You have the option to not answer some of the questions and still remain in the study.

Benefits

As a participant in this research study, there will be no direct benefit for you; however, information from this study may benefit other people now or in the future.

Risks

There are no known risks at this time to participation in this study.

Costs

Participation in this study will be of no cost to you.

Compensation

- You will not receive additional payment for taking part in this study as it is expected that participation will be during normal work hours.
- You will be permitted to bill your time to an administrative project number for organizational learning.

Confidentiality:

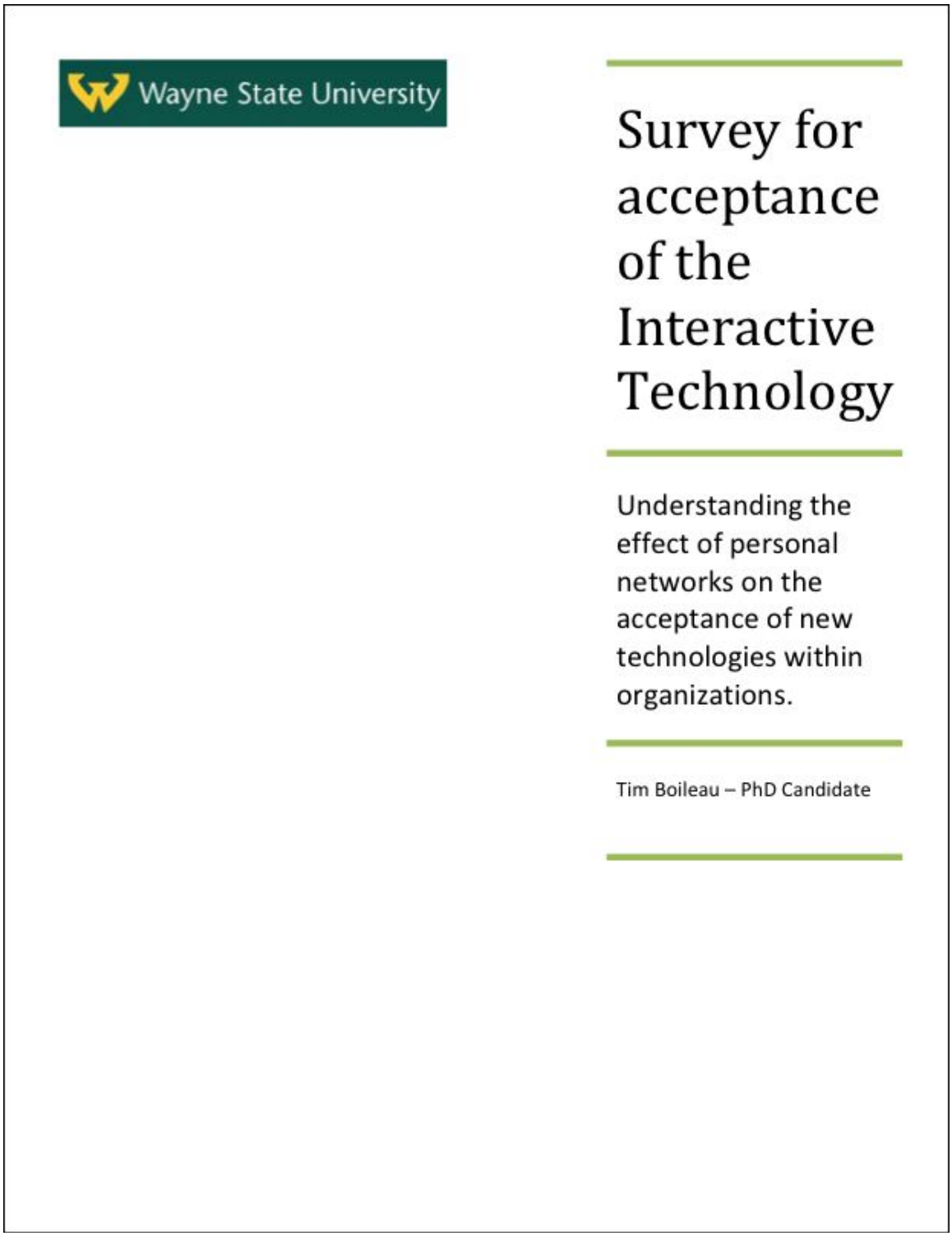
- All information collected about you during the course of this study will be kept without any personal identifiers.
- You will be identified in the research records by a code name or number. There will be no permanent list that links your identity with this code.

Voluntary Participation/Withdrawal:
Taking part in this study is voluntary. You are free to not answer any questions or withdraw at any time. Your decision will not change any present or future relationship with [Company Name] or Wayne State University.

Questions:
If you have any questions about this study now or in the future, you may contact Tim Boileau at the following phone number (313) 333-9842. If you have questions or concerns about your rights as a research participant, the Chair of the Human Investigation Committee can be contacted at (313) 577-1628. If you are unable to contact the research staff, or if you want to talk to someone other than the research staff, you may also call (313) 577-1628 to ask questions or voice concerns or complaints.

Participation:
By completing the survey or participating in an interview, you are agreeing to participate in this study.

APPENDIX B: SURVEY INSTRUMENT



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Acceptance of New Technology Survey

Instructions

Answer questions as they relate to you. For each question, select the one answer that is most applicable to you or fill in the blanks. For the purpose of this survey, "Interactive Technology" refers to software and digital media used to perform your job, collaborate with others, and to faciitate new learning.

Please provide the following

First Name:

Last Name:

☐ Check here if you would like a copy of the final report

Your Age

(Select only one.)

- ☐ 25 or less
- ☐ 26-35
- ☐ 36-45
- ☐ 46-55
- ☐ 56-65
- ☐ 66-75
- ☐ 76 or more

About the Interactive Technology

1. I would find the Interactive Technology useful in my job.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

2. Using the Interactive Technology enables me to accomplish tasks more quickly.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

3. Using the Interactive Technology increases my productivity.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

4. If I use the Interactive Technology, I will increase my chances of getting a raise.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

5. My interaction with the Interactive Technology would be clear and understandable.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

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6. It would be easy for me to become skillful at using the Interactive Technology.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

7. I would find the Interactive Technology easy to use.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

8. Learning to operate the Interactive Technology is easy for me.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

9. People who influence my behavior think that I should use the Interactive Technology .

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

10. People who are important to me think that I should use the Interactive Technology .

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

11. The senior management of this business has been helpful in the use of the Interactive Technology .

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

12. In general, the organization has supported the use of the Interactive Technology .

(Select only one.)

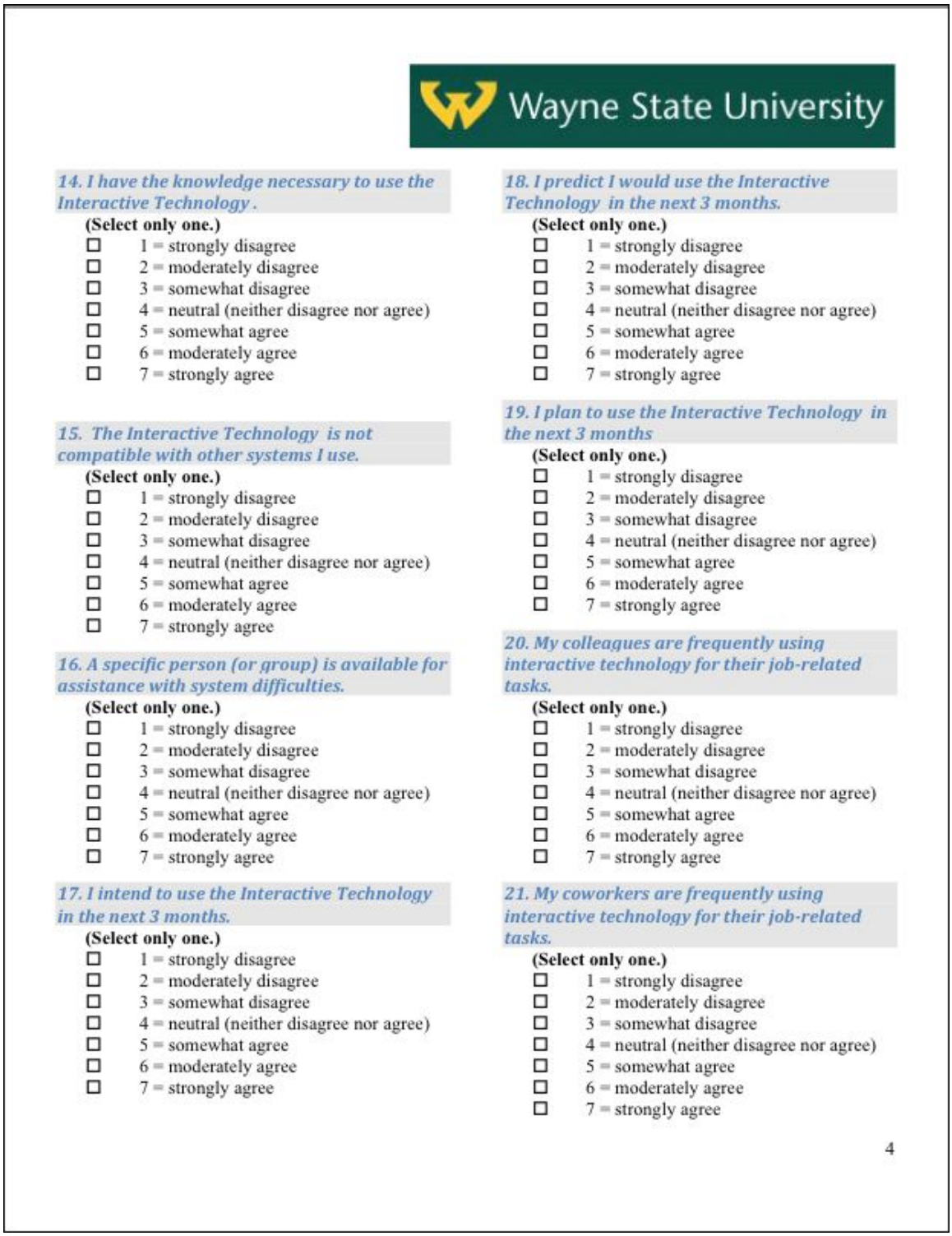
- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

13. I have the resources necessary to use the Interactive Technology .

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

3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14. I have the knowledge necessary to use the Interactive Technology .

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

15. The Interactive Technology is not compatible with other systems I use.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

16. A specific person (or group) is available for assistance with system difficulties.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

17. I intend to use the Interactive Technology in the next 3 months.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

18. I predict I would use the Interactive Technology in the next 3 months.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

19. I plan to use the Interactive Technology in the next 3 months

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

20. My colleagues are frequently using interactive technology for their job-related tasks.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

21. My coworkers are frequently using interactive technology for their job-related tasks.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

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22. My supervisor is frequently using interactive technology for his or her job-related tasks.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

23. My subordinates are frequently using interactive technology for their job-related tasks.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

24. My company's executives are frequently using interactive technology for their job-related tasks.

(Select only one.)

- ☐ 1 = strongly disagree
- ☐ 2 = moderately disagree
- ☐ 3 = somewhat disagree
- ☐ 4 = neutral (neither disagree nor agree)
- ☐ 5 = somewhat agree
- ☐ 6 = moderately agree
- ☐ 7 = strongly agree

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APPENDIX C: SEMISTRUCTURED INTERVIEW GUIDE

Semi-Structured Interview Guide

Q1: What factors are used to identify interactive technology for use at the work group vs. individual level, to enable informal learning and collaboration tied to specific performance outcomes?

1. Think about the ways in which you collaborate with co-workers and team members on a project, and the kinds of technologies that you use such as email, instant messaging, text messaging, document sharing, Skype or others. What factors would you consider in determining which technologies are appropriate for achieving the best performance outcome for the group?

2. How do you determine which interactive technologies (e.g., blogs, wikis, or social networks) to use when you're working by yourself to answer a question, solve a problem, or researching to learn something new?

3. Explain the differences that you perceive in choosing interactive technologies at work verses outside of work.

4. What factors would you use in identifying technology tools for completing tasks that you are directly responsible for in your job?

Q2: What are the rules for the use of interactive technology for peer-to-peer and group collaboration?

5. Think about the different collaborative technology tools that you can access at work such as text messaging, co-authoring a document, or being part of conversation on LinkedIn. What kinds of workgroup rules (formal or informal) are in place covering the use of these tools, when you are working with a teammate on a project or other shared task?

6. How are these rules different when you're working on a team or group activity?

Q3: How does the division of labor (separation of functional groups/roles) affect collaboration and access to technology in related activities leading to aggregate performance outcomes?

7. From your perspective, tell me about how the division of labor among functional groups like creative, IT, account services, and decision sciences affects that way that teams collaborate when working toward a common outcome.

8. In your experience, how are different functional groups using technology differently within the group vs. with team members from other groups?

9. How does your group affiliation or role within a group affect your access and ability to use technology?

Q4: How do different cultural and social settings (e.g., geographical separation and virtual teams) affect the way rules are interpreted in activity-based performance?

10. How do you perceive the cultural differences of working with someone from the Minneapolis office vs. the Detroit office, in the types and use of technology tools that help you do your job?

11. How does working in virtual teams (colleagues in different locations) change the rules for the use of performance support technology?

Q5: How does role perception in division of labor affect individual motivation to engage interactive technology tools for self-directed informal learning activities to achieve a performance outcome?

12. How does the way you personally see your role (i.e., how you think you should do your job) affect your willingness to try new technologies that may increase your knowledge and ability to perform your job better?

Usage Notes:

- Research questions for this study are shown in bold and represent the top level category (i.e., Q1, Q2, Q3, Q4, and Q5) for coding interview data. Sub-categories will be established and refined during analysis and interpretation of the data.

- Numbered questions (i.e., 1-12) will be asked of the participants in a semi-structured interview format with follow-up questions used to render clarity based on the responses received.

APPENDIX D: INITIAL CATEGORY LIST

Interview Date	ID	Q1 categories	Q2 categories
01/12/2011	22026	Need for formality Professional standards Message content	Web search Google Specialty search tools: M-point
		Q3 categories	**Q4 categories**
		Work: search tools to get job done Outside: use of SMS; search tools for personal use	Easy to use Quick result without trial and error F'book is nonsense Limited collaboration; no time Use hotel websites Training dept used to provide updates on best practices, no longer in place
		Q5 categories	**Q6 categories**
		No formal rules Self-policing behavior to for professional and appropriate communications Lines are blurred between professional and personal	More conscious of behavior as group gets larger More professional tone, less joking
		Q7 categories	**Q8 categories**
		Loss of direct task ownership Layers get in the way of collaboration making work convoluted Inefficiency is result of group layers Division of labor gets in the way of getting work done Performance suffers through too many hand-offs	No collaboration Groups do not share a common vision of outcome Lack of dedicated resources and commitment to task Systems get in the way of progress Requires band-aids, breaking rules, and circumventing systems Loss of control over outcome in Door C
		Q9 categories	**Q10 categories**
		Same access to technology for all members of business unit	LOC1 has fewer business obstacles to getting work done--greater separation from mother ship Differences are cultural, not technology related LOC2 has more governance LOC1 more nimble, able to get more done due to fewer obstacles Envious of LOC1 team
		Q11 categories	**Q12 categories**
		Working in virtual teams and cultures increases learning Virtual teams provide new perspectives Virtual technologies enable growth and best practices Increases collaboration and	Love technology Makes job easier Perception of role does not limit desire to learn new technology Technology provides growth and improvement as a manager Find the time to make innovation a

		creativity	priority
1/12/2011	22122	**Q1 categories**	**Q2 categories**
		Email most common, least effective Phone calls engage 50% of attention IM and social media more collaborative Video, IM, SMS greater focus on message Real time video F2F most effective	LinkedIn [business social network] is huge; first and second level connections Leverage relationships for background on people
		Q3 categories	**Q4 categories**
		Personal use public websites Business use company sponsored channels Personal use relationships for recommendations Business rely on colleagues Blogs are too opinionated; lack objectivity; greater trust in personal relationships Greater use of SMS for persona; use of IM for business IM more effective for communicating with customers than emal IM promotes stronger relationships and is more effective and efficient for building trust and access with clients	Doing things faster, farther, differentiates us from our competitors
		Q5 categories	**Q6 categories**
		Too much reliance on email Not enough use of IM and SMS Training and cultural issues [create barriers] Use of collaborative technologies greater with clients and suppliers than internal Leadership not progressive in promoting benefit of IM within and across teams to build more intimate relationships; not a standard Other progressive companies have embraced IM	Should be protocol and guidelines for email and IM Reliance on email slows communication and dilutes message
		Q7 categories	**Q8 categories**
		Need for more collaborative tools Group hubs [SharePoint] do not cross group boundaries Project-focused hub [Basecamp] allows more flexibility	Don't know what other groups are doing E&E based on email and SharePoint No protocol IM and Basecamp could provide faster collaborative environment

		Q9 categories	Q10 categories
		Don't have any more access [as a VP] Company not leveraging tools; not a priority No leadership in implementing productivity and collaboration tools No restrictions on smartphones and data plans	LOC1 is more entrepreneurial and collaborative than LOC2 Easier to get things done in LOC1; less silos LOC1 more nimble, easier to mobilize LOC1 more awareness of resources LOC2 more general service centered, removed from front line business; disadvantage to people in LOC2
		Q11 categories	**Q12 categories**
		Virtual teams are faster and better Co-located teams more hierarchical; too much structure around F2F meetings Virtual teams faster, more collaborative, more adept with tools	Role requires innovation with new technology Customer expectation for new ideas; efficiency and effectiveness bring value Stay on top of what's new in the market to be competitive
1/13/2011	21018	**Q1 categories**	**Q2 categories**
		Ease of use Intuitive Secure Ease of access	Web search Google Educ libraries Reliable source Recommendations by researchers Do not search for new tools
		Q3 categories	**Q4 categories**
		Separate work from personal Facebook: social network LinkedIn: professional network	Ease of use Intuitive Familiar
		Q5 categories	**Q6 categories**
		Respectful tone in communications Access by entire team Shared content in common location	Same rules apply
		Q7 categories	**Q8 categories**
		Groups have favorites Sharepoint vs. Basecamp No integration Duplication of effort and data	Door C has more freedom than IT IT constrained by rule, security, and architecture for new tools
		Q9 categories	**Q10 categories**
		Same access for all members of group Same standards Managers can expense more of mobile cost	LOC2 more corporate LOC1 has more liberty and freedom LOC2 requires stricter compliance
		Q11 categories	**Q12 categories**
		Greater use of interactive technology Increased productivity through IM and Skype	Enjoy using new technologies Help to provide buy-in of business users Inspire team to use new tools

1/13/2011	22030	**Q1 categories**	**Q2 categories**
		Ease of use Quickness Reach multiple colleagues	Web search Google Ease of use Availability
		Q3 categories	**Q4 categories**
		Web search Google Facebook at home Twitter for social community	Comfort level Get the job done Familiar interface
		Q5 categories	**Q6 categories**
		Restricted to tools provided on desktop--no other rules in place Google document sharing	No difference in rules Common sense
		Q7 categories	**Q8 categories**
		No differences for interacting and collaboration Common financials Door C using social media	EXL tools for E&E group; same tool used differently by other groups Tool use dependent on role
		Q9 categories	**Q10 categories**
		Common access to email and similar communications tools EXL permissions based on role	No difference
		Q11 categories	**Q12 categories**
		No difference	Like to try new things and programs Expectation to try new things not tied to role Cannot find and install new software
1/13/2011	22123	**Q1 categories**	**Q2 categories**
		Frequency Response time Historical reference	Web search Google Reference other people Ease of use Conciseness of information Format of [search] return
		Q3 categories	**Q4 categories**
		No difference Phone use same at work and outside More texting during meetings More multitasking	Not always sure what the technologies are Follow trends Webinars and streaming video [education]
		Q5 categories	**Q6 categories**
		Not aware of rules Security guidelines Confidentiality of data	No rules
		Q7 categories	**Q8 categories**
		Groups differ by knowledge of tools Collaboration within a group is easier than outside of it Groups have their own set of tools Some resources are easier to access	Don't know how it is different Technology tied to business unit Use of technology embedded in products or services offered
		Q9 categories	**Q10 categories**

		Role does not limit access to technology Access is based on individual decision Rules not tied to personal selection Not required to have any technology beyond what is provided	No difference Individuals may use technology differently; not affected by location
		Q11 categories	**Q12 categories**
		Some use of virtual meetings for realtime content sharing and review No video conferencing within group	Technology helps the team Technology can be easily introduced Feel motivated to bring new technology to the team Obligation to provide team with the best tools Technology must add value to be adopted
1/14/2011	21119	**Q1 categories**	**Q2 categories**
		Project needs Security Confidentiality Proximity of team; remote team members Work hours Complexity of project	Work or hobby related Difficulty in finding information on topic YouTube [video] instruction substitute for hands-on learning
		Q3 categories	**Q4 categories**
		Availability	Time to find and use technology Value vs. results Context and setting
		Q5 categories	**Q6 categories**
		Rule = barrier Crowd acceptance becomes informal law [group norm] Personal accounting for activity Audit [document] trail Few formal rules Have it--use it	Rules are different Individual barriers to use of technology extend to group Common tools used by all
		Q7 categories	**Q8 categories**
		Groups adopt their own technologies for sharing information [SharePoint vs. Basecamp] Requires workarounds Magnifies restrictions on inter-group collaboration	Differences among groups: use of IM Tools provide faster communication within group
		Q9 categories	**Q10 categories**
		Depends on activity How company needs to be represented Advocate for a certain technology	There is a gap LOC1 more nimble and advanced with technology Different outcomes LOC1 more open minded

			LOC2 closer to corporate center [constrained]
		Q11 categories	**Q12 categories**
		Time zone difference Different tools in LOC1 vs. LOC2 LOC1 willing to take more risk with technology End-user computing laws [perceived] Unofficial adoption / acceptance of Skype in both locations	Limited time to learn--disappointing sometimes Must be quick to learn Familiar user interface Not an early adopter; bleeding edge Expected to be knowledgeable of trends in technology Informed opinion and advocacy
1/14/2011	21120	**Q1 categories**	**Q2 categories**
		Ease of use Help get job done Others using it Personal experience and familiarity	Based on need Quality of source [information] Reputable source Web search Google Scholarly source; academic Google
		Q3 categories	**Q4 categories**
		Different groups Company supported tools like SharePoint Outside work; use what other people use like Facebook What makes sense Free services when not reimbursed	Has to help get job done Easy to use Consistent Compatibility [for collaboration] Familiarity; frequent use Not painful
		Q5 categories	**Q6 categories**
		Formal rules apply to transactional interactions Work documents kept on work assets i.e., computers Company rules [discourage] use of technologies where access and membership can't be controlled Formal communication with boss use email [company standard] Informal communication with colleague use SMS or other technology	Comfort level of group i.e., email vs. SharePoint Close colleagues may use IM, else email
		Q7 categories	**Q8 categories**
		Different tools among different groups e.g., SharePoint vs. Basecamp; both solve the same problem for the group using the tool Common organizational tools are email, SMS and phone Senior executives collaborate in the same document pushing it from one owner to the next; no repository	Within project teams, informal IM Across project teams, formal email Program team level always formal, email to copy stakeholders and gain commitment No value in SMS commitment

		Q9 categories	**Q10 categories**
		Access probably not universal IT takes more liberties in trying new technologies Feel obligated to use new technologies	Lack of relationships [daily interactions] strain communications Emails misinterpreted
		Q11 categories	**Q12 categories**
		Less interaction among virtual team members Greater use of interactive technologies with people you 'see' on a daily basis LOC1; remote office: more empowered independence expected LOC2 work closer on details	Obligation to try new tech based on role Tougher to learn technology creates a challenge to figure it out
1/17/2011	13010	**Q1 categories**	**Q2 categories**
		client directed quicker response get more done always connected benefit to company	topic needs topic context Research: Google & Bing Social: Facebook separation of work and social [all research is social] what others have done
		Q3 categories	**Q4 categories**
		Facebook [social networking] ubiquitous at home and work Always on internet Loss of personal communication	Sales role Rely on search tools for content (Google, Bing, YouTube)
		Q5 categories	**Q6 categories**
		data security process no [explicit] rules	no real difference limit us of IM email or phone Individual personality Adapt to style of other team member
		Q7 categories	**Q8 categories**
		Too many groups Confusion about responsibilities Relationships build familiarity / trust Know strengths and weaknesses Learn personality types and communication styles	Not familiar with other groups No perceived difference Use of mobile; constantly connected Limited IM
		Q9 categories	**Q10 categories**
		[use of technology] encouraged Company is adopting new ways of doing business	More likely to call LOC2 to build relationships Phone call to reinforce email Emphasis on building relationship
		Different dynamic No different rules	Personal interest and desire to learn new technology

			Important to keep up to date for clients Concern of loss of personal comm skills in business
1/17/2011	13012	**Q1 categories**	**Q2 categories**
		Location; tend to work with locals In-person, email, IM Client interaction via LiveMeeting	Default to Google Reliability of info Official sites Wiki Social media sites Blogs
		Q3 categories	**Q4 categories**
		Similar criteria Google search Facebook for social	Depends on task No formalized system LiveMeeting for external global groups Social media for sense of chatter Surf the web--adventure Different sources
		Q5 categories	**Q6 categories**
		Documentation needs email provides permanent record Document sharing for mark-up and collaboration Versioning	Don't use IM F2F meetings for co-located groups Email is primary for extending group, copying all, tracking, documentation LiveMeeting for extended access by other groups
		Q7 categories	**Q8 categories**
		Depends on approach Typical: meet at as a team then retreat to groups Creates dissolution of team Focus on project team is most effective	LOC2: more of a difference LOC1: less difference Similar methods; use of web / mobile Less aware of what other groups do
		Q9 categories	**Q10 categories**
		No negative effect Access to available technology Program specific Software may not have been bought May not fit within the culture e.g., VM No perceived limitations Hub of wheel to use tools for comm	LOC2: everything is digital, no hardcopy Electronic sharing Struggle to build personal relationships, bonds Need more focus on human connections
		Q11 categories	**Q12 categories**
		Complete dependence on support tech Have to use all tools More challenging than collocated teams	Open to learning Help for team Expedite results Builds client credibility

1/17/2011	13113	**Q1 categories**	**Q2 categories**
		Familiarity Expectations Stakeholder buy-in Training	Web search Google
		Q3 categories	**Q4 categories**
		Generally, no difference Access via work	End user needs Intuition No conscious criteria factors
		Q5 categories	**Q6 categories**
		No rules No restrictions	Group access to tool & information
		Q7 categories	**Q8 categories**
		Group technology preferences Cross-communicating not apparent to other teams	Group strengths Individual comfort levels Not about the group Individual differences--some are more open to technology Technology barriers
		Q9 categories	**Q10 categories**
		No effect Within group: no restrictions no rules no difference	LOC2 superior technology Prerequisite in Door C; tech intellect Technology is freely shared in LOC2 In LOC1, you have to ask for it LOC2 [Door C] always on the leading edge with latest technology; expectation to use it LOC2 employees have stronger technology backgrounds
		Q11 categories	**Q12 categories**
		No evidence of virtual teams Doesn't change rules	No role-based expecations Free to try new technologies Constrained by role [outsider] trying to get inside
1/19/2011	13104	**Q1 categories**	**Q2 categories**
		speed; formality efficiency importance size of audience audit trail	depth authoritativeness credibility client consumption ability to cite
		Q3 categories	**Q4 categories**
		Outside work: web Importance Same search discipline as work Entertainment: more relaxed	Familiarity Standard tools MS Office
		Q5 categories	**Q6 categories**
		Traditional ways for doc sharing Business standards: review, mark-up, feedback Timely Fewest resources	Ability to share, provide feedback more difficult Central decision authority needed No technology for group doc editing; done point to point

		Convenient Quick Turnaround	Group distribution; individual return
		Q7 categories	**Q8 categories**
		Some groups more collaborative than others Some groups more responsive Frequency and reach Some groups require high frequency of contact to affect action	Some tools indigenous to business units Knowledge of tools tied to methodologies not shared between groups--only outputs No opportunity to learn about other tools
		Q9 categories	**Q10 categories**
		No perceived group obstructions Some tools specific to role Tools tied to role Should be cross-trained in other role-based tools	LOC2 (Door C) elitist in use of technology LOC1 (Door C) early adopters; not elitist
		Q11 categories	**Q12 categories**
		Barriers: time and distance Greater reliance on technology Increased frequency of use Lag in technology Prefer f2f	Belief should use more technology Does not seek it or ask for it Feelings of anxiety for not understanding technology
1/20/2011	11101	**Q1 categories**	**Q2 categories**
		permanence historical live-virtual review ease-of-use	habit Google-ubiquitous robust search tools quickness to answer
		Q3 categories	**Q4 categories**
		entry point more lazy approach (home) learning for fun vs. work	feature set ease of use brand-UI familiarity interoperability
		Q5 categories	**Q6 categories**
		familiarity social setting formality w/ clients etiquette expectations of others company rules for media access	etiquette formality social setting
		Q7 categories	**Q8 categories**
		group social rules rules of engagement rules of interaction rules of media usage group 'tribe' structures	comfort level more apt to tinker in IT more variety in IT diversity in IT common standards internal vs. external
		Q9 categories	**Q10 categories**
		ability/comfort level experience information access researcher role proactive recommendation	social differences LOC2--better access to technology inequality causes frustration

		new people/old hardware high-end machines for developers common access	
		Q11 categories	**Q12 categories**
		increased usage benefit to F2F reliance on phone virtual whiteboards less effective more emails more IM's more LiveMeetings increase with greater distribution of teams	need for proactive outgoing w/ tech old coots left behind new era innovation required tied to satisfaction desire to be best at what you do competitive tools provide edge personal value in doing well
1/20/2011	13005	**Q1 categories**	**Q2 categories**
		common platform comfort level [ease of use] speed / efficiency feedback w/o redundancy size of team [diversity of team] functional groups	subject matter general vs. specific industry
		Q3 categories	**Q4 categories**
		[similar approach] same tools industry specific home shopping	company provided tools meet needs do not look for new tools
		Q5 categories	**Q6 categories**
		client authorization access based on need-to-know unwritten rules: -change mgt -version control informal rules: -role-based interaction and participation	p2p & group similar p2p less rules, less formal group more explicit
		Q7 categories	**Q8 categories**
		silos change dynamic and effectiveness role awareness role expectations group comfort zone won't work right outside of zone	technologies based on function, job specific use of common platforms (email)
		Q9 categories	**Q10 categories**
		tools required for job seek out tools client driven tool access based on role (e.g., leaders, biz dev, SalesForce)	different roles / technologies aids effectiveness separate document repositories common email
		Q11 categories	**Q12 categories**
		virtual platforms common access	embrace technology awareness

		rules are amplified strong leadership formal rules for engagement	client solutions fascinating / fun new things [innovate]
1/24/2011	12115	**Q1 categories**	**Q2 categories**
		accuracy email is key [paper trail]	no social networking web/Google quickest way
		Q3 categories	**Q4 categories**
		synchronous comm Personal: Skype Work: IM	least time web search no particular tool
		Q5 categories	**Q6 categories**
		political correctness proof for accuracy proper tone in written comm version control change tracking	little difference requires someone to manage
		Q7 categories	**Q8 categories**
		more complexity groups work differently challenging happy medium [common ground]	simpler within group group systems fewer errors outside members add complications need for more follow-up
		Q9 categories	**Q10 categories**
		tools to do the job access to info access not based on role	LOC1 culture less structured Easier comm in LOC1 LOC2 response lag more challenging more process
		Q11 categories	**Q12 categories**
		more time more check points	try new things keep up with current trends part of the job continuous learning stay ahead of clients
1/24/2011	13111	**Q1 categories**	**Q2 categories**
		Ease of use Quick adoption Tied to business results	Web search Google No bias sources or methods Not proactive in technology
		Q3 categories	**Q4 categories**
		Outside work: limited use of technology At work: use technology only if tied to the job	Company provided tools
		Q5 categories	**Q6 categories**
		No rules	No rules; common sense
		Q7 categories	**Q8 categories**
		No effect	No direct knowledge
		Q9 categories	**Q10 categories**
		Available 24/7 via Blackberry Higher in the organization, greater access expected	Use of technology about the same LOC2 response slower; next day Lowered expectation for response

		Blurred lines between work and home--where work gets done	from LOC2 LOC1 response more immediate iPhone users respond more quickly than Blackberry users
		Q11 categories	**Q12 categories**
		No effect No rules; do your job Asynchronous communication via desktop computer No Skype or video	Willing to learn for job Only adopt and use technology provided by company No client affect on use of technology; limited interaction
1/25/2011	12007	**Q1 categories**	**Q2 categories**
		ease of use shared use	social referral word of mouth
		Q3 categories	**Q4 categories**
		outside work; social, entertainment client work	ease of use company required use by peers
		Q5 categories	**Q6 categories**
		Formal: work needs proprietary info info security Informal: work focused not social	same
		Q7 categories	**Q8 categories**
		groups adopt different tools (Skype, Basecamp) adopt practices from other groups based on community needs	comm challenges different technologies used different norms (i.e., email vs. Skype)
		Q9 categories	**Q10 categories**
		CS less access CS less advanced tools than other groups	comm more formal with other geo/culture formality in interactions due to lack of personal relationships
		Q11 categories	**Q12 categories**
		increased/forces use of technology technology makes it easier for distributed teams to communicate	increased collaboration with dist team members adopt tools but do not research them expected to support new tools model behaviors
1/26/2011	23017	**Q1 categories**	**Q2 categories**
		Intuitive Easy to adopt Familiarity	Trusted source Ease of access Speed in finding answers Use of company website Wikipedia UGC; constant updates; validation [community based knowledge]
		Q3 categories	**Q4 categories**
		Similar approach to technology for work and outside of work	Use of tools provided Company and enterprise standards

		Work use more project collaboration tools Separation between personal and professional social networks	Need to broaden use of social tools to increase interactivity and collaboration
		Q5 categories	**Q6 categories**
		Acceptable in the workplace Confidentiality Access controls Information security framework Archival ability Traceability Documentation	Differences in team; more collaborative media and channels Rules for document control, versioning, change management Rule for how often to meet as a group Rules for adding other technologies Rules and expectations are set in advance
		Q7 categories	**Q8 categories**
		Area for improvement Cross-functional solutions for clients Need specialty areas with mechanisms to enable collaboration for the best outcome	Look for collaborative tools that can span internal groups and clients like Basecamp
		Q9 categories	**Q10 categories**
		IT by nature is structured in approach to tools and technologies Adopt more collaborative and open source tools with best practices from other offices	LOC1 is a more interactive space LOC1 more nimble with tools and frameworks LOC1 less bureaucratic, smaller group LOC2 more corporate, bigger, disparate focus LOC2 more separation among groups, less synergy, slower to respond
		Q11 categories	**Q12 categories**
		Don't have a good way to enable virtual team Not just timezone difference; toolset limitation Need strategies and tools to enable collaboration	Not an early adopter, prefer release 2 Not bleeding edge, stability is more important Calculated risk in bringing on new technology Like to try new technology where there is value as in collaborative tools
1/27/2011	22124	**Q1 categories**	**Q2 categories**
		Accessibility Size network [number of people using technology] Difficulty [to use] Engagement [level]	Ease of use Speed [results] Web search Google Public domain Subscription search
		Q3 categories	**Q4 categories**
		Search subscriptions at work Different equipment at work vs. home [Mac vs. PC; iPod Touch vs.	Easy access to sources

		Blackberry] Distinction in social media between work and personal	
		Q5 categories	**Q6 categories**
		Permission for use of web-cam; web conference IM usage in web conference should be limited to topics being discussed Professional conduct Established [standardized] set of tools	Professional conduct rules are the same Advance notice of technology usage Understanding of how to use tools by all group members
		Q7 categories	**Q8 categories**
		Collaboration doesn't change All members have a voice Technology training occurs ahead of time	Different dynamics: department, company, group layout, and client Technology comfortable with client: IM, web conf, Skype
		Q9 categories	**Q10 categories**
		Roles requires use of technology Access to technology must work for group	Difference in way groups & depts are organized in LOC1 vs. LOC2 LOC1 more holistic view of business LOC1 willing to take risks with technology LOC1 willing to cross dept lines LOC1 takes ownership of process LOC1 able to make decisions faster LOC2 is bigger and more departmentalized LOC2 slow to make decisions
		Q11 categories	**Q12 categories**
		Challenges not technology related Need to build proficiency as a virtual worker All workers not able to work virtually F2F interaction is more limited Need to be able to motivate virtual colleagues Team must be comfortable using technology Demeanor becomes more important in virtual teams	Willingness to use technology higher in role as virtual worker Adoption of technology tied to increased effectiveness in job Have to seek opportunities to apply skills and add value Easy to become forgotten without constant innovation for process, products, client solutions Identify weaknesses in gaps between departments like creative and IT
1/27/2011	22128	**Q1 categories**	**Q2 categories**
		Everyone using the same technology Common platforms e.g., email, SMS Peer to peer vs. peer to client Use technology that clients' or	Web search Google Secondary research; subscription database services Blogs for personal

		peers use	
		Q3 categories	**Q4 categories**
		Inside work technology depends on who you are collaborating with Outside of work typically peer to peer (email, IM, SMS)	What's available through company Research group has access to other tools
		Q5 categories	**Q6 categories**
		Informal rules: keep communication professional via email; non-judgmental, non-personal Formal rules: non-plagiarism; preservation of personal and company reputation	Rules are the same Group interaction is more formal
		Q7 categories	**Q8 categories**
		Groups and roles have access to different tools Have to rely on others to do their job Have to trust expertise of others to use their tools Rely on others to provide information that is usable and understandable	Groups are very siloed in terms of technologies Groups are responsible for managing technology issues
		Q9 categories	**Q10 categories**
		Email is primary technology used Proprietary technology access is client-driven	Do not see any difference between LOC2 and LOC1 Same groups use same tools in both location
		Q11 categories	**Q12 categories**
		Don't see a difference Common tool is email May have rules governing access and use of additional collaborative technology	Motivation to try new technologies comes from client needs Need to continue learning about new technologies in client role Would not necessarily seek out new technologies but enjoy using them
1/28/2011	12006	**Q1 categories**	**Q2 categories**
		ease of use accessibility one-stop shopping	content type of information info reliability
		Q3 categories	**Q4 categories**
		outside work; opinion based work; factual importance	dictated by company comp subscription info reliability
		Q5 categories	**Q6 categories**
		no formal rules business etiquette no informal rules	more personalities
		Q7 categories	**Q8 categories**
		more to manage business rules	group preference knowledge sharing tools add benefit

			shared drive, common tools
		Q9 categories	**Q10 categories**
		no difference; everyone has same access needs based no restrictions	no perceived difference Mac vs. PC no perceived diff in work
		Q11 categories	**Q12 categories**
		more important for distributed teams share and communicate	advocacy leadership assimilation by example

APPENDIX E: HIC APPROVAL FORM

WAYNE STATE UNIVERSITY

HUMAN INVESTIGATION COMMITTEE
87 East Canfield, Second Floor
Detroit, Michigan 48201
Phone: (313) 577-1628
FAX: (313) 993-7122
http://hic.wayne.edu

NOTICE OF EXPEDITED APPROVAL

To: Timothy Boileau
Administration & Organization Stud

From: Dr. Scott Millis S. Millis, PhD
Chairperson, Behavioral Institutional Review Board (B3)

Date: December 02, 2010

RE: HIC #: 116310B3E
Protocol Title: The Effect of Interactive Technology on Informal Learning and Performance, in a Social Setting
Funding Source:
Protocol #: 1011009057

Expiration Date: December 01, 2011

Risk Level / Category: Research not involving greater than minimal risk

The above-referenced protocol and items listed below (if applicable) were **APPROVED** following *Expedited Review* Category (#7)* by the Chairperson/designee *for* the Wayne State University Institutional Review Board (B3) for the period of 12/02/2010 through 12/01/2011. This approval does not replace any departmental or other approvals that may be required.

- This protocol has met all criteria at 45 CFR 46.110 and 111 for expedited review approvals.
- Revised Protocol Summary Form, revisions dated 11/20/10, received in the HIC Office on 11/23/10.
- Revised Research Information Sheet, dated 11/20/10.

* Federal regulations require that all research be reviewed at least annually. You *may* receive a *"Continuation Renewal Reminder"* approximately two months prior to the expiration date; however, it is the Principal Investigator's responsibility to obtain review and continued approval ***before*** the expiration date. Data collected during a period of lapsed approval is unapproved research and can ***never*** be reported or published as research data.
* All changes or amendments to the above-referenced protocol require review and approval by the HIC **BEFORE** implementation.
* Adverse Reactions/Unexpected Events (AR/UE) must be submitted on the appropriate form within the timeframe specified in the HIC Policy (http://www.hic.wayne.edu/hicpol.html).

NOTE:

1. Upon notification of an impending regulatory site visit, hold notification, and/or external audit the HIC office must be contacted immediately.
2. Forms should be downloaded from the HIC website at ***each*** use.

*Based on the Expedited Review List, revised November 1998

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ABSTRACT

THE EFFECT OF INTERACTIVE TECHNOLOGY ON INFORMAL LEARNING AND PERFORMANCE IN A SOCIAL SETTING

by

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Major: Instructional Technology

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This study is based on a qualitative multiple case study research design using a mixed methods approach to provide insight into the effect of interactive technology on informal learning and performance in a social business setting inhabited by knowledge workers. The central phenomenon examined is the variance in behavioral intention towards interactive Web 2.0 technologies in learning and performance-related activities, depending on social and cultural setting, observable in individual and group usage patterns.

The theoretical foundation for this study is drawn primarily from the activity theory model developed by Engeström (1987) and related research enabled by an ongoing review of the literature. Two new research frameworks have been developed and presented in the analysis and discussion chapters, respectively, of this study: 1.) A three-stage framework for data analysis in qualitative research; and 2.) A matrix of mutually exclusive categorical themes affecting behavioral intention, aligned with primary and secondary mediators of activity identified in the activity theory model. Current research covering activity theory and workplace learning, and implications for social learning related to

performance has been synthesized with the findings from this study, and included in the discussion chapter.

The results of this study demonstrate that there are six identifiable mediators of activity tied to informal learning and performance in an organizational setting. The mediators identified are: tools, rules, division of labor, collaboration, cultural/social setting, and personal perception of role. These mediators were derived from the activity theory model and subsequently addressed by the research questions using an in-depth interview protocol. Existing research models for behavioral intention in technology acceptance were also applied, producing a validated survey instrument that yielded a set of mutually exclusive categorical themes for analysis of categories associated with each research question during the analysis phase of the study. The categorical themes shown to have an affect on behavioral intention are: performance expectancy, effort expectancy, explicit social influence, facilitating conditions, and implicit social influence. The net result is a framework for analyzing human performance that aligns each of the categorical themes shown to affect behavioral intention within each of the mediators for activity, based on an activity systems view of informal learning and performance. Further research is needed to validate these constructs by studying activity systems within other organizational and institutional settings.

AUTOBIOGRAPHICAL STATEMENT

Throughout my personal, professional, and academic life, I have been driven by a need to discover and create new ways of experiencing the changing world that we share. Technology has played a central role in this journey and I feel fortunate to have been born during the baby-boomer generation, to have witnessed all that I have. It has always been my belief that the value of technology can only be fully realized through its application for solving problems, enriching peoples' lives, and creating new opportunities to connect and learn with others. This belief has been shaped by thirty years as a human performance technologist, and fourteen years as a graduate level faculty member.

This perspective of a technology-enabled, lifelong learner is what led me to pursue my doctoral studies in interactive and human performance technologies. Indeed, from an academic perspective, it seemed a natural transition from my undergraduate studies in electronic and software engineering, to graduate studies in computer information systems, and legal, moral and ethical studies related to the worldwide Web. In the relatively short time since I began my doctoral studies, the world has undergone dramatic changes via the emergence of the Web 2.0, leading to the democratization of information and enablement of personal learning communities on a global scale, increasingly accessible to anyone with a mobile device. Information sharing and curation leading to knowledge base development and learning is now instantly available to nearly 70% of the world's population. As with technology, I believe that the true value of knowledge is in improving the human condition and the world we inhabit.