

ABSTRACT

Title of Dissertation: **VIRTUAL TEAM MEMBER
PERFORMANCE AND VIABILITY: THE
INFLUENCE OF INDIVIDUAL
CHARACTERISTICS**

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The use of virtual teams is increasing in organizations. Virtual teamwork occurs when team members collaborate using technology-mediated communication rather than face-to-face. Research has shown that virtual teamwork can be challenging. However, currently there is little research to help organizations identify team members who are most likely to be effective in a virtual teamwork environment. Given this, the purpose of my dissertation research was to identify individual characteristics that influence a virtual team member's contribution to team performance and team membership viability.

This dissertation developed and tested a theoretical model that integrates literature identifying individual team member characteristics that are directly germane to effective functioning in a team operating virtually. These characteristics include virtual teamwork knowledge, skills, and abilities (KSAs); self-regulatory team orientation; and preference for face-to-face communication with team members.

These individual characteristics were hypothesized to influence team member contribution to team performance and membership viability through the intervening variables of virtual teamwork behaviors and attitude toward virtual teamwork with the team. In addition, team technology support and empowering team leadership were two contextual factors predicted to moderate the hypothesized relationships between team member characteristics and virtual teamwork behaviors.

The hypotheses were tested using data from 193 team members in 29 virtual teams in the procurement department of one large multinational company. The data were collected from team members and team leaders using online surveys, and hierarchical linear modeling was used to analyze the data. Results showed that both virtual teamwork KSAs and self-regulatory team orientation, although not directly associated with virtual teamwork behaviors, interacted with empowering team leadership to influence virtual teamwork behaviors. Self-regulatory team orientation and preference for face-to-face communication were both found to be positively associated with attitude toward virtual teamwork. Results further showed that virtual teamwork behaviors and attitude toward virtual teamwork were both positively associated with contribution to team performance and membership viability. Finally, no support was found for the hypothesized moderating influence of team technology support on the relationship between team member characteristics and virtual teamwork behaviors.

VIRTUAL TEAM MEMBER PERFORMANCE AND VIABILITY:
THE INFLUENCE OF INDIVIDUAL CHARACTERISTICS

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2008

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Acknowledgements

My Ph.D. journey would not have been possible without the help and support of *many* people. First, my love and thanks to my husband, Gregg, who encouraged me to start this journey with the simple words “Just do it!” He and my son, Gregg Jr., have provided support and encouragement every step along the way, and celebrated my arrival at each new milestone.

I owe a special thanks to Kay Bartol, my Dissertation Chair, who has been a mentor from the start of my program, and has helped to make sure the path for my journey was clear. She has generously shared her tremendous knowledge and experience to help me develop the skills to succeed, and pushed me to pursue excellence in every aspect of my academic career. I would also like to thank the members of my committee who have provided constructive guidance and support for my dissertation research. In addition, thank you to Myeong-Gu Seo and Susan Taylor for their collaboration, mentorship, and humor.

I am also lucky to have been in the company of the doctoral students in the Management and Organization department. Their support and friendship provided reassurance that I was not undertaking this journey alone. I could not have asked for better company along the way. Finally, thank you to the rest of my family, friends, and members of the Ph.D. Project whose boundless support helped me to keep pushing forward.

My sincere thanks to you all!

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Chapter 1: Introduction

According to a recent estimate more than 60% of professional employees engage in some degree of virtual teamwork (Kanawattanachai & Yoo, 2002). Virtual teamwork occurs when team members communicate using technology (e.g., instant chat, email, telephone) rather than face-to-face (Fiol & O'Connor, 2005; Kirkman & Mathieu, 2005). The growth of virtual teams in organizations is likely due to the significant benefits they can provide. Virtual teams offer the opportunity to select the best individuals to work on a task regardless of location. This makes them ideally suited to support business strategies, such as globalization, outsourcing and other forms of inter-organizational strategic partnering (Axtell, Fleck, & Turner, 2004; Hertel, Geister, & Konradt, 2005; Martins, Gilson, & Maynard, 2004; Powell, Piccoli, & Ives, 2004). They can also help organizations pursue greater speed and flexibility in meeting customer needs, while at the same time reducing the need for employee relocation.

Despite the potential benefits of virtual teams, virtual team members face a number of challenges, which can negatively impact team member performance and satisfaction. These challenges arise from the need to collaborate with other team members across time and space. For example, existing research shows that compared to members of traditional teams, virtual team members are more likely to experience conflict than traditional face-to-face teams (Hinds & Bailey, 2003; Hinds & Mortensen, 2005), and have more difficulty building trust with other team members (Gibson & Manuel, 2003; Warkentin, Sayeed, & Hightower, 1997). Given these challenges, it is important that organizations prepare virtual team members to be

effective in their virtual teamwork (Rosen, Furst, & Blackburn, 2006). Yet, most organizations fail to take this proactive approach (Rosen et al., 2006).

This situation is not helped by the fact that currently little research exists to provide guidance to organizations on the characteristics of individuals who are likely to be most successful in virtual teams. Recent reviews of the virtual team literature have all highlighted the need for more research in this area. (Axtell et al., 2004; Furst, Blackburn, & Rosen, 1999; Hertel et al., 2005; Martins et al., 2004; Powell et al., 2004; Webster & Staples, 2006). For example, Powell et al. (2004, p.16) summarized this research need: “Who should be a member of a virtual team? If a manager has several people to choose from, how does he or she decide which employee to place on the virtual team? Very little work has been done on any personal characteristics of team members.”

In light of this, the purpose of this dissertation was to develop and test a theoretical model that integrates literature identifying individual team member characteristics that are directly germane to effective functioning in a team operating *virtually*. Specifically, this study explicated three critical characteristics that are important for virtual teamwork: virtual teamwork knowledge, skills, and abilities (KSAs); self-regulatory team orientation; and preference for face-to-face communication with team members. The theoretical model also shows how these team member characteristics translate into important individual, but team-relevant outcomes through the intervening variables of virtual teamwork behaviors and attitude toward virtual teamwork. These outcomes include both contribution to team performance and team membership viability (propensity toward further work on the

team). Examining virtual team member outcomes beyond performance is particularly important in a virtual team (Powell et al., 2004), since the challenges of working virtually are likely to negatively impact affective outcomes (for reviews, see Axtell et al., 2004; Martins et al., 2004; Powell et al., 2004; Raghuram, Garud, Wiesenfeld, & Gupta, 2001). To my knowledge, there has been no published empirical research that examines the influence of individual characteristics on virtual team member performance and affective outcomes.

This study also examined contextual factors that influence the relationships that link team member characteristics to team member virtual teamwork behaviors. In their review of the virtual team literature Martins et al (2004) and Powell et al. (2004) have noted the need for greater concern with contextual variables in attempting to better understand the functioning of individuals in virtual teams. Specifically, this study focused on two contextual factors that have been shown to be important in a virtual team: team technology support and empowering team leadership (e.g., Kirkman, Rosen, Tesluk, & Gibson, 2004, 2006).

Chapter Overview

Chapter 2 develops the theoretical model and related hypotheses that are tested in this dissertation. It first describes the theoretical framework that links individual characteristics to virtual team member outcomes. This is followed by a description of the team member characteristics in the model and hypotheses that relate these characteristics to virtual teamwork behaviors and attitude toward virtual teamwork. Next, hypotheses are developed to describe how team contextual factors moderate the relationships between team member characteristics and virtual

teamwork behaviors. A final set of hypotheses describe the influence of virtual teamwork behaviors and attitude toward virtual teamwork on individual contribution to team performance and team membership viability.

Chapter 3 describes the research methodology. This includes the research sample, procedure, and measures. Chapter 4 presents the analytic techniques used to analyze the data collected in this study and results of the analyses that test the study hypotheses. Finally, Chapter 5 concludes with a discussion of the major findings from this dissertation, theoretical and practical implications, limitations, and suggestions for future research.

Chapter 2: Theory Development and Hypotheses

This chapter develops the study hypotheses, which are summarized at the end of the chapter.

Virtual Team Definition

A team has been defined as “a collection of individuals who are interdependent in their tasks, who share responsibilities for outcomes, who see themselves and are seen by others as an intact social entity embedded in one or more larger social systems, and who manage their relationships across organizational boundaries” (Cohen & Bailey, 1997, p. 241). Virtual teams are a specific type of team in which team members rely on technology-mediated communication (e.g., phone, email, and instant chat), rather than face-to-face interaction for collaboration (Kirkman & Mathieu, 2005). Virtual team researchers generally agree that team virtuality exists as a continuum. In other words, teams are seldom entirely virtual or entirely face-to-face, but instead they vary in the degree to which they rely on technology-mediated communication (Martins et al., 2004). Given the goal of understanding team member characteristics that are directly germane to effective functioning in a team operating *virtually*, the teams examined in this study were teams in which interactions between team members were predominantly technology-mediated.

It is important to note that the definition of virtuality used in this research does not make any assumptions regarding a virtual team member’s place of work. For example, virtual teams have been defined by Workman, Kahnweiler, and Bommer (2003, p. 200) as “a group of teleworkers who collaborate through an electronically

mediated infrastructure.” They define teleworkers as employees that work in a remote location, such as one’s home (Raghuram et al., 2001; Wiesenfeld, Raghuram, & Garud, 1999; Workman et al., 2003). The definition of a virtual team used here includes virtual team members who might work in a central office location, or remotely away from the office. In other words, regardless of location, these individuals are engaged in collaborative work with others. The terms virtual teamwork and virtual collaboration are used interchangeably in this document.

Theoretical Framework

Explicating characteristics of individuals who are likely to be most successful in virtual teams requires an explicit focus on individual outcomes in the team. This is in line with existing research that has examined factors that influence individual outcomes in teams (Barry & Stewart, 1997; Chen, Donahue, & Klimoski, 2004; Ellis, Bell, Ployhart, Hollenbeck, & Ilgen, 2005; Hirschfeld, Jordan, Feild, Giles, & Armenakis, 2006; Leach, Wall, Rogelberg, & Jackson, 2005; McClough & Rogelberg, 2003; Miller, 2001; Morgeson, Reider, & Campion, 2005; Neuman & Wright, 1999; Shaw, Duffy, & Stark, 2000; Stevens & Campion, 1994, 1999). This study focused on two team member outcomes: contribution to team performance and team membership viability.

At the individual level, performance has been conceptualized as individual contribution to team performance (e.g., Barry & Stewart, 1997; Shaw et al., 2000). Researchers have also stressed the importance of considering, not only performance related outcomes as a measure of effectiveness in a team, but also the member’s ability to function as an intact unit and retain its members over time (Hackman, 1987;

Sundstrom, De Meuse, & Futrell, 1990). This aspect of team effectiveness has been called team viability. Although team viability is a team level construct, it manifests itself at the individual level as team member satisfaction and future willingness to work with the team (Tesluk & Mathieu, 1999; Sundstrom et al., 1990). Researchers have measured these two important dimensions as individual outcomes that contribute to team viability (Tesluk & Mathieu, 1999). This study took a similar approach and refers to these two dimensions collectively at the individual level as team membership viability (hereafter referred to as membership viability). Membership viability is a team member's propensity toward further work with the team as reflected in satisfaction with working in the team and willingness to work with team members in the future (Phillips, Douthitt, & Hyland, 2001; Sundstrom et al., 1990; Tesluk & Mathieu, 1999).

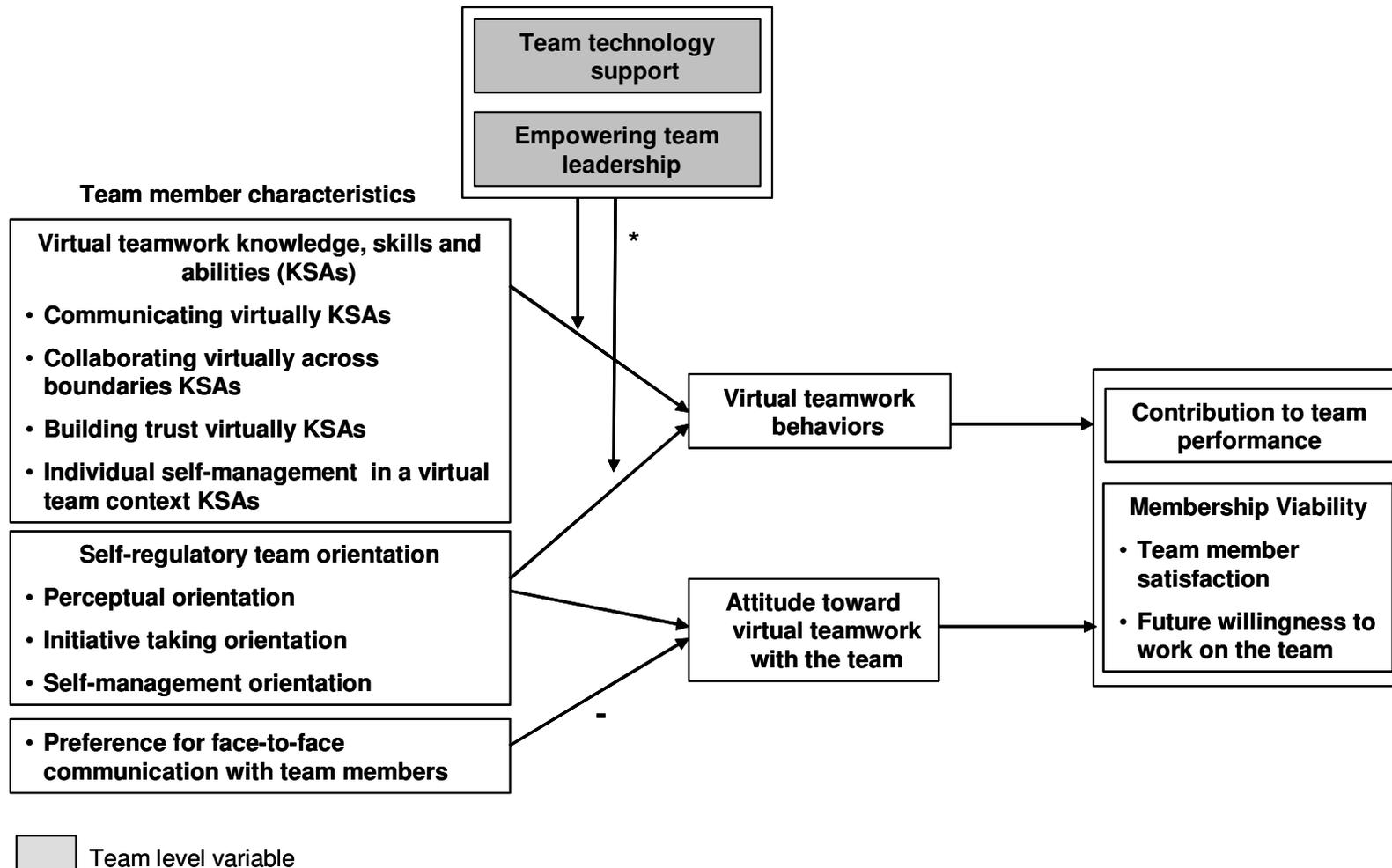
Although several theoretical perspectives were used in developing the study hypotheses, the Input-Mediator-Output-Input model (IMOI; Ilgen, Hollenbeck, Johnson, & Jundt, 2005) was applied as an organizing framework to relate team member characteristics to team member outcomes. Ilgen et al. (2005) proposed this model as an enhancement to the Input-Process-Output (IPO) framework that has been used extensively in team research (Guzzo & Shea, 1992). According to this model, inputs (I: e.g., attributes that team members bring to the team) influence outcomes (O: e.g., performance and viability). This relationship is mediated by several factors (M), which include teamwork processes (behaviors in which team members engage to interact with each other and convert inputs to outputs), and other cognitive or affective states (e.g., attitudes, values, motivations, and cognitions) that develop as

team members interact as a team. The final I in the IMOI model represents the notion of cyclical causal feedback, in which outcomes in the team become inputs to future lifecycles of the team. Note that this feedback loop was not included in the theoretical model tested in this study; however, the implications of this feedback loop for relating a team member's past virtual teamwork experiences to future virtual teamwork outcomes is considered in the Discussion section.

According to Ilgen et al. (2005) one of the important advantages of the IMOI model over existing IPO frameworks is that it recognizes both behavioral processes and emergent affective states as intervening variables that relate inputs to outputs. The theoretical model developed and tested in this study applies the IMOI model at the individual level to predict that team member characteristics influence a team member's behaviors and attitude related to virtual teamwork, and that these behaviors and attitude in turn influence a team member's contribution to team performance and membership viability. The theoretical model is shown in Figure 1 (on the next page). Each component of the model is discussed in more detail in the section below, starting with individual characteristics of the virtual team member.

Figure 1

Theoretical Model



*This moderating effect is negative for empowering leadership

Team Member Characteristics for Virtual Teamwork

There are a range of characteristics that might be considered in a model of virtual team member effectiveness. However, research suggests that deep-level characteristics (e.g., stable traits and abilities) have a stronger influence on performance in teams than surface level characteristics (e.g., age and education level; for a review, see Bell, 2007). In a recent meta-analysis, Bell (2007) identified three types of deep-level characteristics that have been associated with team effectiveness. These include: (1) knowledge, skills, and abilities (KSAs: attributes that can be developed, for example through training); (2) stable traits (an individual's characteristic pattern of thinking, feeling, and acting that predisposes them to behave in certain ways); and (3) individual values (beliefs about desirable behaviors) or preferences (individual's characteristic response to certain situations).

In order to achieve a more complete understanding of how team member characteristics influence virtual teamwork outcomes, each of these three types of characteristics was included in the model. The characteristics in the model are virtual teamwork knowledge, skills, and abilities (KSAs); self-regulatory team orientation; and preference for face-to-face communication with team members. These characteristics were derived from a review of virtual team research to identify important requirements for collaboration in a technology-mediated environment. Next, I describe each of the team member characteristics shown in Figure 1 before developing hypotheses that relate them to team member outcomes.

Virtual Teamwork Knowledge, Skills, and Abilities

To effectively engage in a task individuals must have the appropriate knowledge (facts or procedures), skills (competency in performing a task), and abilities (mental capacity to perform a task; Noe, 2005). Knowledge, skills, and abilities (KSAs) can be developed, for example, through training. Of interest here are KSAs that allow a team member to engage in effective virtual teamwork with others. Several researchers have argued that the KSA requirements for traditional teamwork provide neither sufficient alignment with, nor efficient coverage of KSA requirements for virtual teamwork (Blackburn, Furst, & Rosen, 2003; Furst et al., 1999; Powell et al., 2004). This is because of the unique challenges that team members face in interacting across time and space using technology. Given this, there is a need to identify KSAs that are particularly germane to a virtual teamwork environment. Figure 1 shows the four categories of virtual teamwork KSAs that were examined in this study. These include KSAs related to communicating virtually, collaborating virtually across boundaries, building trust virtually, and individual self-management in a virtual team context.

Communicating virtually KSAs. The first category of virtual teamwork KSAs is related to communicating effectively with dispersed individuals using technology (Blackburn et al., 2003; Cramton, 2001; Maruping & Agarwal, 2004; Maznevski & Chudoba, 2000; Shin, 2004). Several important aspects of this KSA category have been identified in the virtual team literature. First, communicating virtually involves selecting the appropriate communication media for different communication tasks (Blackburn et al., 2003; Maruping & Agarwal, 2004; Maznevski & Chudoba, 2000;

Shin, 2004). Theories, such as media richness theory (Daft & Lengel, 1986) and its extension, media synchronicity theory (Dennis & Valacich, 1999), have been used as the basis to show that the degree to which the technology used fits the requirements of the task, i.e., the degree of task-technology fit, predicts team outcomes (e.g., Goodhue & Thompson, 1995). This is because tasks differ in the degree of information processing, coordination, and communication required for successful completion. Similarly, technologies differ in their ability to convey richer information (for a review, see Maruping & Agarwal, 2004). In general, tasks that involve a higher level of uncertainty (no clear solution) and equivocality (resolution of multiple conflicting viewpoints) will create the need for higher levels of interactivity between team members and a richer communication medium. As an example, Blackburn et al. (2003) stated that sharing routine information may merely require email; whereas solving a complex problem requires a richer communication medium such as a teleconference. Further, resolving a stalemate requires an even richer medium such as video conference.

Other important aspects of communicating virtually are aimed at creating mutual knowledge in the team. Mutual knowledge is knowledge that team members share in common and know that they share (Krauss & Fussell, 1990). Mutual knowledge facilitates effective virtual teamwork by ensuring that team members have a shared understanding of the team's goals, task, processes and what each team member brings to the team (Cramton, 2001; Hinds & Weisband, 2003). Virtual team members have difficulty establishing mutual knowledge for several reasons. Communicating electronically can impair the communication process by reducing the

ability to transmit non-verbal and contextual cues that help to give meaning to messages (for a reviews, see Cramton, 2001; Hinds & Weisband, 2003). In addition, virtual team members often fail to explicitly communicate important contextual information (e.g., local work demands, holiday schedules, and local work processes) that are important for understanding the communications and behaviors of other team members (Cramton, 2001; Hinds & Weisband, 2003). Finally, technical difficulties and communication delays can also lead to unevenly distributed communication between team members (Cramton, 2001; Hinds & Weisband, 2003).

A virtual team member can take several actions to overcome these challenges to creating mutual knowledge. These include clarifying the meaning of messages sent by highlighting the parts of the message that are particularly important, and expressing emotions and other non-verbal information as part of the message (e.g., through the use of emoticons and emphasis; Blackburn et al., 2003; Cramton, 2001; Shin, 2004; Warkentin & Beranek, 1999). It is also important to share relevant contextual information that provides important background information that will help other team members make sense of a team member's communications and behaviors (Blackburn et al., 2003; Cramton, 2001; Katz & Te'eni, 2007; Shin, 2004). Finally, unequal distribution of information in the team can be avoided by making sure communications have been received, and understood by all team members (Cramton, 2001).

In summary, important aspects of the KSA category of communicating virtually include selecting the appropriate communication media for different communication tasks, communicating cues and contextual information that will help

team members better understand the meaning of communications sent, and verifying receipt and understanding of messages sent.

Collaborating virtually across boundaries KSAs. The second category of virtual teamwork KSAs is related to working with others across cultural, functional, and organizational boundaries (Bell & Kozlowski, 2002; Blackburn et al., 2003; Duarte & Snyder, 2001; Shin, 2004). Duarte and Snyder (2001) referred to the application of these KSAs as “crossing boundaries.” They have also been called “lateral skills,” referring to a set of skills required to collaborate with and learn from individuals who are from different backgrounds and perspectives (Cohen & Mankin, 1999; Shin, 2004). Collaborating effectively across boundaries is important in virtual teams because these teams tend to be more diverse than co-located teams (Bell & Kozlowski, 2002; Blackburn et al., 2003; Duarte & Snyder, 2001; Jarvenpaa & Leidner, 1999; Shin, 2004), operate in different contexts, and use different local work processes (Hinds & Mortensen, 2005).

The cross-cultural literature is a helpful source for identifying different aspects of KSAs related to collaborating virtually across boundaries. Cross-cultural researchers have identified KSAs for effective interaction with other individuals from different national cultural backgrounds (Black & Mendenhall, 1990; Earley & Peterson, 2004; O'Sullivan, 1999; Shaffer, Harrison, Gregersen, Black, & Ferzandi, 2006) and these are likely to also be applicable to working, not only across cultural boundaries, but across functional, organizational, and other boundaries that exist in a virtual team.

One aspect of working with others across boundaries identified by cross-cultural researchers is perceptual questioning (Mendenhall & Oddou, 1985; O'Sullivan, 1999). Perceptual questioning involves suspending judgment, objectively questioning what one is observing, gathering cues to gain a better understanding of another's behavior, questioning one's own default judgments, and considering different potential interpretations of the situation. Perceptual questioning is critical for virtual team members because researchers have shown that in a virtual teamwork environment where team members lack situational information about each other, a team member is more likely to make dispositional rather than situational attributions for another's behaviors. This can negatively impact group cohesion and increase conflict in the team (Cramton, 2002; Cramton, Orvis, & Wilson, forthcoming). Perceptual questioning can help to mitigate this tendency. When virtual team members exercise perceptual questioning skills, they are taking the time to understand the actions and perspectives of other team members, which is a first step toward working through those differences and identifying trade-offs.

Another important aspect of working across differences that has been identified by cross-cultural researchers is constructive conflict resolution (Mendenhall & Oddou, 1985; O'Sullivan, 1999). Research has shown that virtual teams experience higher levels of conflict than traditional co-located teams and this conflict is more difficult to overcome (Hinds & Bailey, 2003; Hinds & Mortensen, 2005; for a review, see Mortensen & Hinds, 2001). In addition, task related conflict, which in traditional teams has been found to have positive effects, is more likely to turn into affective or interpersonal conflict in a virtual team, and this can be damaging to team performance

(Hinds & Bailey, 2003; Hinds & Mortensen, 2005; Mortensen & Hinds, 2001). Given this, differences in the team need to be managed collaboratively, whereby a team member seeks solutions that address the needs and goals of the other and maximizes gains for both sides (Lewicki & Litterer, 1985).

In summary, important aspects of the KSA category of working virtually across boundaries include perceptual questioning (suspending judgment, seeking clarifying information, seeking to understand the other person's perspective), and applying a collaborative conflict resolution approach.

Building trust virtually KSAs. The third category of virtual teamwork KSAs is related to building trust with other members of the team (Blackburn et al., 2003; Duarte & Snyder, 2001; Jarvenpaa, Knoll, & Leidner, 1998; Jarvenpaa & Leidner, 1999; Shin, 2004). Trust refers to the belief that another individual makes efforts to fulfill commitments, is honest, and does not seek to take advantage of opportunities (Cummings, Schlosser, & Arrow, 1996; Dirks & Ferrin, 2001). The reduced face-to-face interaction in a virtual team makes it difficult for team members to directly observe and monitor the behavior of others. Therefore trust provides a form of psychological safety which allows team members to take the risk of cooperating with other members of the team because they have the expectation that their actions will be reciprocated (Gibson & Manuel, 2003; Handy, 1995; Zolin, Hinds, Fruchter, & Levitt, 2004). As a result, trust has been described as an enabling condition for virtual team effectiveness (Gibson & Cohen, 2003), and virtual team research has shown that trust plays a pivotal role for effective virtual team functioning (Jarvenpaa & Leidner, 1999).

To build trust virtually team members must understand the importance of trust for virtual teamwork and act in ways that signal trustworthiness to other team members. Research has shown that building trust in a virtual team differs from the way in which trust develops in face-to-face teams (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). This is because the reduced social information exchange and tendency for depersonalization associated with technology-mediated communication makes it difficult for an individual to form an impression of others in the same way that might occur with face-to-face interaction. Whereas in more traditional teams, trust is typically conceptualized as either an affective or a cognitive construct with emphasis on feeling, commitment and exchange (Mayer, Davis, & Schoorman, 1995; McAllister, 1995); in a virtual team, two important aspects of building trust are related to how an individual approaches the task and communicates with the team (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999).

Trust in a virtual team has been associated with being proactive and following through on commitments (Blackburn et al., 2003; Duarte & Snyder, 2001; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). Related to this, several researchers have stressed the need for team members to take the initiative in sharing leadership in the team (for a review, see Hill, 2005). To overcome barriers caused by differences in time and distance, team members must proactively seek out relevant information, keep in contact with team members, and identify new ways of working to bridge these differences (Blackburn et al., 2003; Duarte & Snyder, 2001). Communication behaviors that facilitate trust include engaging in proactive, frequent and predictable communications; taking care to avoid long silences; providing prompt

responses to team member questions; communicating with a positive, encouraging tone; and providing substantive input and feedback when requested by the team (Cramton, 2001; Hart & McLeod, 2003; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999).

In summary, important aspects of the KSA category of building trust virtually include taking initiative; following through on commitments; and engaging in frequent, predictable, substantive communication that is positive in tone.

Individual self-management in a virtual team context. The fourth category of virtual teamwork KSAs relates to completing assigned tasks with little supervision, monitoring, and feedback from the team leader or other team members (Bell & Kozlowski, 2002; Blackburn et al., 2003; Duarte & Snyder, 2001; Shin, 2004). Traditional teamwork KSAs have focused primarily on self-management at the team level, such as setting team goals, planning and coordinating tasks between team members (e.g., Stevens & Campion, 1994). The reduced interaction with the team leader and other members in a virtual team makes it important for virtual team members to focus on their own individual self-management. However, they must do this in a way that is congruent with the overall goals of the team. Research has shown that individuals can be trained to be self-managing (Frayne & Geringer, 2000). Important aspects of self-management include self-identifying the behaviors that need to be improved; self-goal-setting; self-monitoring progress toward those goals, making adjustments, as necessary; and using self-reinforcement (or self-criticism) based on performance (Frayne & Geringer, 2000; Manz & Sims Jr., 1987). Closely

linked to self-management is also effective time-management, which researchers have argued is an important skill for virtual team members (Blackburn et al., 2003).

In summary, important aspects of the KSA category of individual self-management in a virtual team context include self-identifying areas for improvement, self-goal-setting, self-monitoring, self-reinforcement (or self-criticism), and effective time management in completing task assignments, in a way that aligns with virtual team goals.

Self-regulatory Team Orientation

The second team member characteristic shown in Figure 1 is self-regulatory team orientation. Self-regulation refers to individual processes that enable an individual to guide his or her goal-directed activities over time and across changing circumstances, including the modulation of thought, affect, and behavior (Kanfer, 1990; Karoly, 1993; Kozlowski & Bell, 2006; Porath & Bateman, 2006). Examples of individual self-regulation tactics for improving performance include feedback seeking behaviors, proactive behaviors, and goal setting behaviors (Kozlowski & Bell, 2006; Porath & Bateman, 2006). In a virtual teamwork environment self-regulation is particularly important because, as argued earlier, team members are often not collocated with the team leader or other team members who might offer guidance and motivation to work effectively in the team. Further, in a team environment it is important that individual self-regulation is directed toward successful accomplishment of the team's task and toward effective interactions with team members. In other words, individual team member self-regulation should be team-focused.

An orientation is a form of instrumental trait, or a trait that describes behaviors that have an impact on an individual's environment (Buss & Finn, 1987). More specifically, orientations describe observable behavioral inclinations or tendencies within a given sphere (Hogan, Hogan, & Busch, 1984; Liao & Rupp, 2005; Westaby & Lowe, 2005). Team-focused self-regulatory orientation (hereafter referred to as self-regulatory team orientation) is therefore a trait that describes a team member's stable tendency to engage in individual self-regulation behaviors that are aligned with team task accomplishment and effective interactions with team members.

The theoretical model in Figure 1 identifies three dimensions of a self-regulatory team orientation that are directly relevant to meeting the requirements for virtual teamwork discussed in the previous section. The first dimension, perceptual orientation, describes the tendency to engage in self-regulation behaviors that contribute to effective interactions with team members by collaborating effectively across boundaries in the team. The second dimension, initiative taking orientation, describes the tendency to engage in proactive behaviors that help to accomplish the team's task and that are important for building trust with other team members in a virtual team. Finally, self-management orientation describes the tendency to engage in behaviors to accomplish individual task assignments independently with little oversight by a team leader or other team members.

Perceptual orientation. An orientation identified in the expatriate adjustment literature that is relevant to working across boundaries in a virtual team is perceptual orientation (Mendenhall & Oddou, 1985). Perceptual orientation is defined as the

tendency to be open-minded and non-judgmental when interpreting the behaviors of others (Mendenhall & Oddou, 1985). Perceptual orientation is an important aspect of a self-regulatory team orientation because it relates to self-regulating one's interaction with other team members to avoid conflict and foster collaboration when interacting with others who are different. I have argued above that KSAs related to perceptual questioning are important to develop in virtual team members; however, individuals who are high in perceptual orientation have a natural tendency to make less rigid or looser evaluations as to why others behave as they do, tend to seek out more informative data to guide their reactions to others, and tend to update their perceptions and beliefs as new data arise (Mendenhall & Oddou, 1985).

These tendencies closely parallel those described for mindfulness, a construct that has been argued to influence an individual's cross-cultural intelligence (Thomas, 2006). Cross-cultural intelligence describes an individual's ability to interact effectively with people who are culturally different (Earley & Ang, 2003).

Mindfulness is defined as the practice of three basic principles (Langer, 1989, 1997): (1) questioning one's automatic behavior, (2) avoiding premature judgments and being open to new information, and (3) considering alternative perspectives.

Mindfulness has a stable trait component (Walach, Buchfeld, Buittenmueller, Kleinknecht, & Schmidt, 2006); whereby some individuals have a greater tendency than others to engage in mindful behaviors.

Initiative taking orientation. As discussed earlier in relationship to building trust, actions associated with being task-focused, proactive, and taking initiative will help to gain the trust of other members of the team. These types of behaviors have

been defined as important for self-regulation. (Porath & Bateman, 2006). The construct of personal initiative describes an individual's tendency to exhibit these behaviors by taking an active, self-starting approach to work; and going beyond what is formally required in a given job (Frese, Fay, Hilburger, & Leng, 1997). Personal initiative is also closely related to the individual trait of proactivity (Frese et al., 1997), which includes behaviors related to scanning for opportunities, showing initiative, taking action, and persevering to solve a problem in order to bring about change (Bateman & Crant, 1993). In a virtual team environment, these behaviors when aligned with the goals of the team, are important for overcoming obstacles that might hinder task completion, and so are an important component of a self-regulatory team orientation. In this study, initiative taking orientation describes the behavioral tendencies associated with personal initiative and proactivity in a team environment.

Self-management orientation. Self-management orientation refers to a team member's tendency to engage in self-managing behaviors (Haines III, St-Onge, & Archambault, 2002; Uhl-Bien & Graen, 1998). These include self-identifying behaviors to be improved, self-goal setting, self-monitoring, and self-reinforcement (or self-criticism; Manz & Sims Jr., 1987). As discussed earlier, it is important for individuals in virtual teams to be self-managing and self-regulate completion of their task assignments because of the reduced interaction with the team leader and other team members. Although individuals can be trained to develop self-management KSAs (Frayne & Geringer, 2000), research has also shown that individuals differ in their natural tendency to engage in self-managing behaviors (Haines III et al., 2002; Uhl-Bien & Graen, 1998)

Preference for Face-to-face Communication with Team Members

The third team member characteristic depicted in Figure 1 is preference for face-to-face communication with team members. As discussed earlier, a defining feature of virtual teamwork is lack of face-to-face interaction with other team members. As a result, to understand factors that influence team member outcomes in this environment, it is important to consider attributes that influence how a team member responds to working in an environment in which most of the communication is technology-mediated. Existing research in diverse fields has shown that individuals differ in their preference for using different communication media. For example, in the marketing literature researchers have identified individual differences in consumers' preference for communicating face-to-face as opposed to electronically with a service employee (Dabholkar, 1996).

There is also research to show that individual differences can influence media preferences (for a review, see Topi, Valacich, & Rao, 2002). For example, Topi et al. (2002) argued that the personality trait of extraversion (Costa & McCrae, 1985) would influence individuals' desire for face-to-face communication, since extraverts' greater need for external stimuli can be satisfied better in a rich rather than a lean communication environment. Other researchers have found that individuals' national culture influences use of email for communication (Downey, Wentling, Wentling, & Wadsworth, 2005; Straub, Keil, & Brenner). For example, in cultures where there is an emphasis on respect for authority, face-to-face communication is preferred.

Preference for face-to-face communication has not been explicitly examined as a construct in a teamwork environment, but as discussed above, there is research

evidence to suggest its importance. This evidence suggests that team members vary in the extent to which they prefer and have a positive response to working in a teamwork environment that requires that they communicate with other team members using technology. Kock's (2004) psychobiological model argues that humans have genetically evolved to be more efficient at and to prefer face-to-face communication. Since virtual teamwork is a change from the traditional form of communication in a team (i.e., communicating face-to-face with others), this preference is discussed in terms of the extent to which team members prefer the more traditional way of interacting in a team (i.e., individual's preference for face-to-face communication).

Influence of Team Member Characteristics on Virtual Teamwork Behaviors and Attitude Toward Virtual Teamwork

Virtual Team Member Behaviors

Teamwork behaviors describe how individuals work with others in the team. Research has shown that a team member's teamwork related KSAs and stable traits, influence his or her teamwork behaviors (e.g., Barry & Stewart, 1997; Neuman & Wright, 1999; Stevens & Campion, 1999). Given the focus of this study on virtual teamwork, the behaviors of interest are virtual teamwork behaviors, or the behaviors displayed by a team member that facilitate effective interactions in a virtual teamwork environment. These behaviors relate directly to the requirements for effective virtual teamwork derived from virtual team research, and reviewed earlier in relation to identifying virtual teamwork KSAs. They include behaviors related to communicating virtually, collaborating virtually across boundaries, building trust virtually, and

individual self-management in a virtual team context. I predict that both virtual teamwork KSAs and self-regulatory team orientation will positively influence the extent to which a team member engages in virtual teamwork behaviors.

First, with regard to the predicted relationship between virtual teamwork KSAs and virtual teamwork behaviors, there is a large body of research to show that task-related KSAs positively influence performance on a task (e.g., McCloy, Campbell, & Cudeck, 1994). Also, according to the demands-abilities fit perspective from person-environment fit theory (Schneider, 2001), when an individual has the requisite KSAs to meet the demands of his or her work environment, that individual will perform better in that environment. This prediction has been supported by empirical research (for a review, see Kristof-Brown, Zimmerman, & Johnson, 2005). In support of these arguments and findings, previous research has shown a positive relationship between teamwork KSAs and teamwork behaviors (e.g., Chen et al., 2004; Ellis et al., 2005; Hirschfeld et al., 2006; Leach et al., 2005; McClough & Rogelberg, 2003; Miller, 2001; Morgeson et al., 2005; Stevens & Campion, 1994, 1999). Accordingly, I predict that a team member with a higher level of virtual teamwork KSAs will be more likely to engage in behaviors that support effective virtual teamwork.

Hypothesis 1: A team member's level of virtual teamwork KSAs is positively associated with virtual teamwork behaviors.

Since self-regulatory team orientation consists of behavioral tendencies, they reflect the way in which individuals are likely to interact with others in a virtual team. Several researchers have shown that orientations predict context-specific behaviors

described by the orientations, and also mediate between deeper level personality traits and these context specific behaviors (Brown, Mowen, Donovan, & Licata, 2002; Liao & Rupp, 2005; Parker et al., 2006). For example, Brown et al. (2002) showed that customer orientation influenced performance in a customer service environment, and mediated the relationship between big five personality traits (Costa & McCrae, 1985) and customer service performance. Based on these arguments and findings from previous research, I make the following prediction.

Hypothesis 2: A team member's self-regulatory team orientation is positively associated with virtual teamwork behaviors.

Attitude Toward Virtual Teamwork with the Team

Attitudes are an individual's evaluation of an object ranging from positive to negative (Olson & Zanna, 1993; Petty & Wegener, 1997; Weiss, 2002). Based on this definition, attitude toward virtual teamwork is defined as an individual's evaluation ranging from positive to negative of virtual teamwork with his or her team. A team member's attitude toward virtual teamwork is important because attitude toward teamwork has been shown both theoretically and empirically to relate to teamwork effectiveness (Gregorich, Helmreich, & Wilhelm, 1990; Stout, Salas, & Fowlkes, 1997; Thoms, Pinto, Parente, & Druskat, 2002).

As shown in Figure 1, both self-regulatory team orientation and preference for face-to-face communication with team members are predicted to influence attitude toward virtual teamwork. This argument is based on a needs-supply perspective of person-environment fit theory (Kristof, 1996), which suggests that individuals are more likely to develop positive attitudes toward a given work environment when their

needs, preferences, desires are met by that work environment. Since, self-regulatory team orientation describes an individual's behavioral tendencies, the higher the team member's self-regulatory team orientation, the more a virtual teamwork environment will fit how a team member is inclined to work with members of the virtual team. As a result, the team member is likely to have a more positive attitude toward collaborating virtually with his or her team. In other words, when a team member works against his or her natural tendency more negative attitudes are likely to develop.

Hypothesis 3: A team member's self-regulatory team orientation is positively associated with attitude toward virtual teamwork with the team.

Similarly, when the virtual teamwork environment provides the opportunity to communicate with other team members in a way that matches the individual's natural communication preference, then more positive attitudes will result. This argument is supported by research that has shown that consumers' who have a lower need for interaction during service delivery have a more positive attitude toward technology-based self-service options (e.g., Dabholkar & Baghozzi, 2002). Since face-to-face communication is not the primary mode of communicating in a highly virtual team, preference for face-to-face communication is shown in Figure 1 to negatively influence a team member's attitude toward virtual teamwork.

Hypothesis 4: A team member's preference for face-to-face communication with team members is negatively associated with attitude toward virtual teamwork with the team.

Moderating Influence of Team Contextual Factors

The discussion in the previous section describes the relationships between virtual teamwork KSAs and virtual teamwork behaviors. However, as shown in Figure 1, characteristics of the team's context are predicted to moderate these relationships. There is a strong body of evidence from both the situational constraints literature and work performance literature that situational factors can act as constraints that significantly impact individual behaviors. Given this, researchers have called for an increased focus on contextual factors in organizational research theory (Capelli & Sherer, 1991), and in teams research in particular (Ancona, 1990; Ancona & Caldwell, 1992; Guzzo & Shea, 1992; Morgeson, Johnson, Campion, Medsker, & Mumford, 2006; Tesluk & Mathieu, 1999).

This study examined two contextual factors: team technology support and empowering team leadership. Of specific interest here is the role that these contextual factors play in determining how team member characteristics translate into virtual teamwork behaviors. Virtual teamwork behaviors involve interaction with other members of the team and these two factors are particularly germane to facilitating such interaction. First, since technology-mediated communication is a prerequisite for virtual teamwork, many models of virtual team effectiveness have included technology support as a key component (for a review, see Kirkman et al., 2006). Second, given the large body of research that shows that team leaders influence performance in teams (e.g., Druskat & Wheeler, 2003; Durham, Knight, & Locke, 1997; Srivastava, Bartol, & Locke, 2006), team leadership is likely to be an important contextual factor that determines how an individual interacts with other team

members. Virtual team research suggests that empowering team leadership is a type of leadership that will play an important role in determining outcomes in a virtual team (Bell & Kozlowski, 2002; Kirkman et al., 2006). The moderating hypotheses related to these two contextual factors are developed in the remainder of this section.

Team Technology Support

Team technology support refers to the extent to which the team as a whole has adequate access to technology tools required to support virtual collaboration among team members (King & Majchrzak, 2003; Kirkman et al., 2006). Given the importance of task-technology fit (matching the media used to the type of task) discussed earlier (Martins et al., 2004; Powell et al., 2004; Webster & Staples, 2006), virtual team members should have access to a variety of communication media so that they can match the communication medium to the different types of teamwork interactions in which they participate (Blackburn et al., 2003; Kirkman et al., 2006). Furthermore, in a virtual team, technology provides the communication mechanism that helps a team member to apply virtual teamwork KSAs. For example, technology allows a team member to share contextual information, and reach out to other team members to seek understanding of behaviors and resolve conflict. It also helps a team member build trust virtually by facilitating frequent and proactive communications, and allowing a team member to be responsive to requests from other team members. When the team does not have adequate technology support, it will be more difficult for a team member to effectively apply his or her virtual teamwork KSAs to engage in effective virtual teamwork behaviors in the team (Blackburn et al., 2003; Kirkman et al., 2006). As a result, when technology support for the team is high, I predict that

the relationship between virtual teamwork knowledge and virtual teamwork behavior will be stronger than when technology support for the team is low.

Hypothesis 5: Team technology support moderates the positive relationship between a team member's virtual teamwork KSAs and virtual teamwork behaviors, such that this relationship will be stronger when team technology support is high.

Team technology support is also predicted to strengthen the positive relationship between self-regulatory team orientation and virtual teamwork behaviors. As argued above, lack of adequate technology support can make it difficult for team members to engage in effective virtual teamwork behaviors, even if they are inclined to do so. As a result, a higher level of team technology support is predicted to strengthen the positive relationship between self-regulatory team orientation and virtual teamwork behaviors.

Hypothesis 6: Team technology support moderates the positive relationship between a team member's self-regulatory team orientation and virtual teamwork behaviors, such that this relationship will be stronger when team technology support is high.

Empowering Team Leadership

Empirical research on the impact of leadership in virtual teams has been limited, but several researchers have argued that a type of team leadership that will be particularly important in a virtual teamwork environment is empowering leadership (Bell & Kozlowski, 2002; Kirkman et al., 2004). Empowering leadership has been defined as leader behaviors that involve leaders sharing power with subordinates and

raising their level of intrinsic motivation (Srivastava et al., 2006). Empowering leadership behaviors include leading by example, participative decision making, coaching, informing, and showing concern (Arnold, Arad, Rhoades, & Drasgow, 2000). Research has shown that empowering team leaders influence team effectiveness through their influence on team processes and emergent states (Srivastava et al., 2006). Specific to virtual teams, Kirkman et al. (2004) found that a higher level of team empowerment was associated with team performance, and that this relationship was stronger when teams were more virtual (met less frequently face-to-face).

Figure 1 shows that empowering team leadership strengthens the positive relationship between virtual teamwork KSAs and virtual teamwork behaviors. Empowering team leaders encourage team members to reach out to their virtual team members to share knowledge that is important for team functioning (Srivastava et al., 2006). Such a leader will also encourage team members to take the initiative to solve problems and work through differences that arise with their virtual team members. Finally, team members will be encouraged, recognized, and rewarded for taking the initiative to solve problems and taking ownership for their own self-management within the team. At the same time, empowering team leaders, by keeping team members informed and making the goals of the team clear, will ensure that team members are acting in the collective interest of the team as they exercise initiative and self-management. For these reasons, I expect that empowering team leadership will create an environment in which virtual teamwork KSAs are more readily translated into effective virtual teamwork behaviors.

Hypothesis 7: Empowering team leadership moderates the positive relationship between a team member's virtual teamwork KSAs and virtual teamwork behaviors, such that this relationship will be stronger when empowering team leadership is high.

Empowering team leadership is also predicted to attenuate the positive relationship between self-regulatory team orientation and virtual teamwork behaviors. Chen and Kanfer's (2006) theory of motivated behavior in work teams predicts that team level and individual level motivational processes can interact to influence individual performance in teams. Chen, Kirkman, Kanfer, Allen, & Rosen (2007) found empirical support for this prediction in their study of the multilevel influence of empowerment in teams. When team empowerment was high, there was a weaker relationship between individual level empowerment and individual performance than when team empowerment was low (Chen et al., 2007). Empowering team leaders raise the level of intrinsic motivation within the team and promote a collective sense of commitment to and ownership of the team's mission. This causes team members as a collective to have a higher sense of efficacy, be more proactive, willing to work to resolve issues within the team, and more willing to trust (Kirkman & Rosen, 1999; Srivastava et al., 2006). Since this empowered team environment triggers more effective team processes, it can supplement or compensate for lower individual motivation by reducing the difficulty or complexity of individual tasks (Chen & Kanfer, 2006). In other words, in the current study higher levels of empowering team leadership is expected to weaken the positive relationship between self-regulatory team orientation and virtual teamwork behaviors. Conversely, in the absence of

empowering team leadership, it is more important that the individual is motivated to engage in virtual teamwork behaviors as a result of his or her stable behavioral tendencies.

Hypothesis 8: Empowering team leadership moderates the positive relationship between a team member's self-regulatory team orientation and virtual teamwork behaviors, such that this relationship will be stronger when empowering team leadership is low.

Influence of Virtual Teamwork Behaviors and Attitude Toward Virtual Teamwork on Team Member Outcomes

I have described three individual characteristics that are germane to virtual teamwork and developed hypotheses that describe how these characteristics relate to a team member's virtual teamwork behaviors and attitude toward virtual teamwork. Further, I have also argued that factors related to the team context (team technology support and empowering team leadership) will moderate the relationships between team member characteristics and virtual teamwork behaviors. I now turn to the influence of virtual teamwork behaviors and attitude toward virtual teamwork on the team member outcomes of contribution to team performance and membership viability.

Contribution to Team Performance

As mentioned earlier, individual performance in a team has been conceptualized as the extent to which a team member contributes to the overall achievement of the team's goals (e.g., Barry & Stewart, 1997; Shaw et al., 2000). A

team member contributes to team performance by engaging in behaviors that contribute to the task and interpersonal concerns of the team (Barry & Stewart, 1997). Hence, in a virtual team where a significant portion of teamwork occurs virtually, a team member's contribution to performance will be influenced by the extent to which he or she engages in behaviors that help team members to work virtually with each other in completion of the task.

Hypothesis 9: The extent to which a team member engages in virtual teamwork behaviors is positively associated with contribution to team performance.

Attitude toward virtual teamwork is also predicted to influence contribution to team performance. The Theory of Reasoned Action and the Theory of Planned Behaviors posit that attitudes influence behavioral intentions, which in turn influence actual behavior. According to these theories, individuals engage in behaviors that they believe will have positive outcomes that they value. In a teamwork environment, Cannon-Bowers et al. (1997) have argued that teamwork attitudes will be important determinants of effectiveness, and there is empirical research to support this argument. For example, researchers have found that attitudes toward teamwork positively relate to teamwork effectiveness (Gregorich et al., 1990; Stout et al., 1997). More recently, researchers have moved beyond a focus on attitudes toward teamwork in general to focus on attitude toward a specific type of teamwork (e.g., Thoms et al., 2002). For example, Thoms et al. (2002) found that attitude toward self-managing teams was a strong predictor of team member long-term adaptation in self-managing work teams, which included individual performance on the team. Based on these

arguments, I predict that attitude toward virtual teamwork will influence virtual team member performance contribution in a virtual team.

Hypothesis 10: A team member's attitude toward virtual teamwork with the team is positively associated with contribution to team performance.

Membership Viability

As described earlier in this chapter, two components of membership viability are team member satisfaction and future willingness to work on the team. Since job satisfaction has been defined as an evaluative judgment (negative or positive) about one's job or job situation (Weiss, 2002; Weiss & Cropanzano, 1996; Weiss, Nicholas, & Daus, 1999), team member satisfaction can be defined as an evaluative judgment about one's membership in the team. Further, future willingness to work on the team refers to the extent to which a team member desires to stay on the team (Hackman, 1987; Marrone et al., 2007; Sundstrom et al., 1990; Tesluk & Mathieu, 1999).

I predict that more effective virtual teamwork behaviors will lead to higher levels of membership viability. Since cooperation and trust are key to developing a team with a long term ability to work together effectively (Hackman, 1990), viability is positively influenced by conditions that promote cooperation and trust (Balkundi & Harrison, 2006; Barrick, Stewart, Neubert, & Mount, 1998; Foo, Sin, & Yiong, 2006). For example, research has shown that team members who work more collaboratively and achieve higher levels of social integration report higher levels of viability (Barrick et al., 1998; Foo et al., 2006). Virtual team research findings reviewed earlier show that effective virtual teamwork behaviors help a team member to better cooperate and reduce conflict with other team members. They can also help

the team member build trust. For example, a virtual team member can reduce misunderstandings that lead to conflict with other team members by engaging in behaviors that result in more effective virtual communications, and collaborating successfully across differences. (Cramton, 2001; Gibson & Manuel, 2003; Hinds & Bailey, 2003; Hinds & Weisband, 2003; Rafaeli & Ravid, 2003). Also, showing initiative and engaging in self-management behaviors in order to meet commitments can help a team member to earn the trust of others in the team (Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). Given these arguments, I make the following prediction.

Hypothesis 11: The extent to which a team member engages in virtual teamwork behaviors is positively associated with membership viability (team member satisfaction and future willingness to work on the team).

I also predict that attitude toward virtual teamwork with a team will positively influence membership viability because of its influence on team member satisfaction and future willingness to work on the team. With regard to team member satisfaction, individuals evaluate facets or different aspects of the work environment to form overall satisfaction judgments (Highhouse & Becker, 1993; Locke, 1969; Weiss, 2002; Weiss & Cropanzano, 1996). Facets that are particularly relevant to the particular job situation of interest will have more impact on satisfaction judgments (Weiss, 2002). Hence, team member satisfaction will be influenced by the team member's judgment of different facets of team membership that are particularly relevant to the team member's experience in the team. The virtual aspect of working with others (virtual teamwork) is particularly relevant to a team member's overall experience of working in a virtual team. Hence, these findings and arguments suggest

that a team member's overall satisfaction in a virtual team will be shaped by the attitude the team member develops related to virtual teamwork with the team.

In addition, attitude toward working virtually in a team will also have a positive impact on future willingness to work on the team. A team member who likes the virtual aspect of working with team members is more likely to be willing to collaborate with the team in the future. Consistent with this argument, Thoms et al. (2002) found that in self-managing teams, attitude toward self-managing work teams positively influenced a team member's long-term adaptation, which they argued reflects the team member's assessment of his or her adjustment and ability to continue working successfully in the team

Hypothesis 12: A team member's attitude toward virtual teamwork with the team is positively associated with membership viability (team member satisfaction and future willingness to work on the team).

Summary of Research Hypotheses

Hypothesis 1: A team member's level of virtual teamwork KSAs is positively associated with virtual teamwork behaviors.

Hypothesis 2: A team member's self-regulatory team orientation is positively associated with virtual teamwork behaviors.

Hypothesis 3: A team member's self-regulatory team orientation is positively associated with attitude toward virtual teamwork with the team.

Hypothesis 4: A team member's preference for face-to-face communication with team members is negatively associated with attitude toward virtual teamwork with the team.

Hypothesis 5: Team technology support moderates the positive relationship between a team member's virtual teamwork KSAs and virtual teamwork behaviors, such that this relationship will be stronger when team technology support is high.

Hypothesis 6: Team technology support moderates the positive relationship between a team member's self-regulatory team orientation and virtual teamwork behaviors, such that this relationship will be stronger when team technology support is high.

Hypothesis 7: Empowering team leadership moderates the positive relationship between a team member's virtual teamwork KSAs and virtual teamwork behaviors, such that this relationship will be stronger when empowering team leadership is high.

Hypothesis 8: Empowering team leadership moderates the positive relationship between a team member's self-regulatory team orientation and virtual teamwork behaviors, such that this relationship will be stronger when empowering team leadership is low.

Hypothesis 9: The extent to which a team member engages in virtual teamwork behaviors is positively associated with contribution to team performance.

Hypothesis 10: A team member's attitude toward virtual teamwork with the team is positively associated with contribution to team performance.

Hypothesis 11: The extent to which a team member engages in virtual teamwork behaviors is positively associated with membership viability (team member satisfaction and future willingness to work on the team).

Hypothesis 12: A team member's attitude toward virtual teamwork with the team is positively associated with membership viability (team member satisfaction and future willingness to work on the team).

Chapter 3: Research Methodology

Sample and Procedure

Study hypotheses were tested using a field study in which data were collected from a sample of virtual teams working in the procurement organization of one large multinational company. Data for the study were collected from team members and team leaders using online surveys. The different sources from which data were collected are summarized in Table 1. The virtual team members were the focal individuals for the study. They provided data related to team member characteristics, attitude toward working virtually with the team, and viability. Focal team members also assessed the empowering leadership behaviors of the team leader. For each focal team member, 3-5 other members of the team (referred to as peers) assessed the focal team member's virtual teamwork behaviors. These 3-5 peers were randomly selected by the research team. Hence, each team member received two surveys: one completed as a focal team member (focal team member survey), and one completed as a peer rater of other team members (peer survey). Finally, the team leader also rated the focal team member's contribution to team performance and provided data on the level of technical support available to the team (team leader survey). Each participant was assigned a unique ID number that safeguarded the confidentiality of that individual's responses. The IDs also allowed team members to be matched with team leaders and peers.

Table 1

Sources of Study Data

Survey	Respondent	Measures included on survey
Focal individual survey	Team members	<ul style="list-style-type: none"> ▪ Team member characteristics (KSAs, orientation, preference) ▪ Attitude toward virtual teamwork ▪ Membership viability
Peer survey	Team members	<ul style="list-style-type: none"> ▪ Virtual teamwork behaviors of focal team member (each focal team member randomly assigned to assess the virtual teamwork behaviors of 2-4 peers in the team) ▪ Empowering team leadership behaviors of team leader
Team leader survey	Team leader	<ul style="list-style-type: none"> ▪ Team technology support ▪ Contribution to team performance of each team member

The teams were responsible for one of two types of tasks. Sixty-percent of the teams were cross-functional global commodity teams focused on selecting suppliers and managing the supply chain for a global commodity. Their tasks involved establishing global purchasing requirements and reconciling differences in purchasing

specifications across different global locations, identifying and contracting with global suppliers, processing contracts in respective countries, and ongoing vendor assessment and management. The remaining teams were cross-functional process improvement teams responsible for designing and implementing process improvements to increase the quality and efficiency of different aspects of the procurement process. These teams were responsible for identifying and specifying opportunities for process improvement, collecting data to quantify the problem, developing and implementing new processes, and coordinating implementation of process improvements in the different regions. Discussions with a representative from the organization confirmed that both types of teams engaged in teamwork which required team members to work interdependently.

These teams were well-suited to testing hypotheses related to virtual teamwork because all teams were highly virtual. Data collected from team leaders showed that on average, the teams engaged in 92.4% of their interactions using technology. The technologies used for communication were also similar across the teams, and mostly consisted of email and phone/teleconference. Teams ranged in size from 3 to 26 with an average team size of 9.27.

As mentioned above, multiple surveys were used to collect the study data. First, each team member completed both a focal team member survey and then a peer survey, which was sent to the team member two weeks after distributing the focal team member survey. Focal team member surveys and peer surveys were sent to 250 virtual team members working in 29 virtual teams. A team leader survey was also sent to the leader for each team. Responses to the focal team member survey were

received from 194 team members (72% response rate). After matching focal team member survey data with peer data (assessment of focal team member virtual teamwork behaviors) and team leader data (assessment of focal team member performance contribution and team technology support), the final sample used in the study consisted of data for 193 focal team members (71.7% of total focal team members surveyed) in 29 teams. Peer data were only used if at least two peer ratings were available for the focal team member. Team members in the final sample were 66% male with a mean age of 47 years and mean tenure in the procurement organization of 3.7 years. Among the members, 66% were White, 12% Asian, 8% Hispanic, 6% Black, and 8% from other ethnic groups. A wide variety of nationalities were represented in the sample.

Measures

Unless otherwise noted, a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) was used for the survey measures in the study. All survey measures are shown in Appendix 1.

Virtual Teamwork KSAs

Virtual teamwork KSAs was measured as the focal team member's score on a situational judgment test (SJT; Hill & Bartol, 2007). The test assesses knowledge of each of the four virtual teamwork KSA categories discussed earlier: communicating virtually, collaborating virtually across boundaries, building trust virtually, and individual self-management in a virtual team context. Each question on the test describes a hypothetical situation in which the respondent is asked to choose the best response from among four options (for a discussion and review of situational

judgment tests, see McDaniel, Bruhn Finnegan, Morgeson, & Campion, 2001). The test consists of 25 items.

The total score on the test was used as a measure of the amount of virtual teamwork knowledge the focal team member possessed. Situational judgment tests have been used by other team researchers to assess the knowledge component of teamwork related KSAs (e.g., Chen et al., 2004; Ellis et al., 2005; Hirschfeld et al., 2006; Leach et al., 2005; McClough et al., 2003; Miller, 2001; Morgeson et al., 2005; Stevens & Campion, 1994, 1999). These researchers have argued that situational judgment tests have high face validity when written in terms of job situations (Stevens & Campion, 1999), and have shown incremental validity in predicting performance over measures of cognitive ability and other individual measures, such as personality measures (for a review, see meta-analysis by McDaniel, Hartman, Whetzel, & Grubb, 2007).

Briefly, in developing the test, recommended test construction procedures were followed (Haladyna, 1994; Osterlind, 1998). First, questions were written to cover each of the four virtual teamwork KSA categories, which defined the content domain for the test. Situations involving virtual teamwork and the most appropriate responses were identified from the virtual team literature. Care was taken to follow accepted item writing rules (Haladyna, 1994; Osterlind, 1998) when constructing the test questions. The response alternatives were written to have similar social desirability to reduce faking. Three content experts, who had doctorates and extensive knowledge of the virtual team domain, independently evaluated the questions and answers and provided feedback. They also provided feedback on the adequacy of the coverage.

These inputs were used to modify the questions on the test. A reading level assessment was conducted and modifications made to ensure that the test was at an eighth grade reading level. For scoring, each question was scored as 1, if the correct response option was selected; otherwise the respondent received a score of zero. Hence, each question was dichotomously scored as 1 or 0, and the total score was the sum of all the correct answers.

Two pilot tests involving 418 and 371 senior undergraduate students, respectively, were conducted to assess the psychometric properties of the test (reliability, acceptable levels of item-difficulty, and acceptable item-total correlations). After each pilot, the biserial (item-total) correlation for each of the items was assessed to determine which items discriminated well between higher and lower performing participants. Also the difficulty of the items was evaluated to determine which items were too easy in the sense that large number of pilot study participants answered the question correctly. Based on this review, items were deleted or modified, leading to a 28-item test. Below are two sample questions from the test.

*In which of the following situations would it be **best** for you to suggest a face-to-face meeting with a member of your virtual team?*

- a. You are approaching an important deadline for which you and the team member are jointly responsible.*
- b. You are working on an important task for which you need the team member's input.*
- c. You and the team member are located relatively close to each other and could get together without lengthy travel.*

- d. *You and the team member are trying to resolve a complex problem with no clear solution.*

*You have just joined a virtual team in which the major form of communication is email. Which of the following **best** represents an important factor to keep in mind as you send out emails to members of the team?*

- a. *A good rule to follow is to resend an email if the intended receiver has not replied within 24 hours.*
- b. *Receivers of negative email messages are likely to misinterpret them as more intensely negative than intended by the sender.*
- c. *Emails sent out near the end of the work day are likely to receive the most attention by receivers.*
- d. *Copying everyone on the team on all messages that go between any pair of team members is a good way to keep all team members informed.*

For the present study, item analysis showed that three items had low item-total correlations (less than .2; Kehoe, 1995). These were removed, yielding a final test with 25 items that was used in the analysis. The reliability coefficient (Kuder-Richardson 20, KR20) of the 25-item virtual teamwork test was 0.62, which is within the range acceptable for a test of this length and scoring approach (i.e., dichotomous scoring; Kehoe, 1995; Ployhart, Weekley, & Holtz, 2003). This reliability is also comparable to other SJTs published in the organizational literature (Lievens, Buyse, & Sackett, 2005; Lievens & Sackett, 2006; Motowidlo, Dunnette, & Carter, 1990;

Ployhart et al., 2003b; Weekley & Ployhart, 2005). Researchers generally agree that where an SJT is designed to include multiple content areas (e.g., different categories of virtual teamwork KSAs), lower reliabilities may result (Chan, 2006; Lievens et al., 2005; Lievens et al., 2006; Motowidlo et al., 1990; Ployhart & Ehrhart, 2003a).

Self-regulatory Team Orientation

Self-regulatory team orientation was measured as the focal team member's self-report of his or her behavioral tendencies when working in a team (SRTO; Bartol & Hill, 2008). As explained earlier, self-regulatory team orientation is conceptualized as a multidimensional construct (Edwards, 2001) that is reflective of three underlying dimensions: perceptual orientation, initiative taking orientation, and self-management orientation. The items were included in the two pilot studies mentioned earlier to validate the factor structure and the reliability of the dimensions and the overall self-regulatory team orientation scale. As a result of those pilots, some items were dropped or revised for clarity. The items resulting from these pilot tests were used in the present study. Reflecting the focus of this scale on assessing self-regulation in a team environment, each item was preceded by the following stem: "When I am in a team, I tend to..."

Perceptual orientation was measured with 8-items based on the definition of this orientation in the expatriate adjustment literature (Mendenhall & Oddou, 1985) and on the related construct of mindful orientation toward others from the cross-cultural literature (Thomas, 2006). The items describe the extent to which an individual tends to question his or her automatic reactions when interacting with team members from different cultures or backgrounds, suspend judgment, seek out new

information to understand others behavior, and consider the different perspectives of others (e.g., “I tend to pause instead of immediately reacting when a team member does something that bothers me.”). *Initiative taking orientation* was measured with 6 behavioral items adapted from the proactive personality scale (Bateman & Crant, 1993) and Frese et al.’s (1997) personal initiative scale (e.g., “I tend to take the lead to solve problems that arise in the team”). Finally, *self-management orientation* was measured using 6 items related to self-management behaviors from Uhl-Bien and Graen’s (1998) 16-item self-report measure of self-management behaviors. Items were selected that reflected Manz and Sims Jr.’s (1987) description of self-managing behaviors (e.g., “I tend to track my own actions to ensure that I stay on track with my tasks in the team”).

Confirmatory factor analysis (CFA) on the self-regulatory team orientation measure using the data from the current study showed the three orientations as distinct factors [$\chi^2(167, N=193) = 388.98$, non-normed fit index (NNFI) = .88, comparative fit index (CFI) = .89, standardized root mean square residual (SRMR) = .06]. Coefficient alphas for the three dimensions, were .90, .87, and .87 respectively. As expected based on underlying theory, the three orientation dimensions were highly correlated (r between .54 and .70, $p < .001$). The reliability of the self-regulatory team orientation multidimensional construct was assessed using Nunnally and Bernstein’s (1994) approach for computing reliability of a multidimensional variable as the linear composite of the separate dimensions. The linear composite reliability was .95. The three dimensions were averaged into the self-regulatory team orientation variable that was then used in the related analyses.

Preference for Face-to-face Communication with Team Members

Preference for face-to-face communication with team members was measured with 5-items which assessed the extent to which the focal team member prefers to communicate face-to-face when interacting with others in a team (Hill & Bartol, 2007). Following researchers who have argued that face-to-face communication is the natural method for communication between humans (Kock, 2004), but that individuals vary in the extent to which they desire face-to-face communication (Topi et al., 2002), items reflected the extent to which individual preferences aligned with this natural tendency. The items were patterned after a measure by Dabholkar (1996) in the marketing literature that attempts to capture the extent to which consumers desire human interaction during the service process. However, items had to reflect working in virtual teams and, thus, for the most part differ substantially from Dabholkar's items. A sample item is "It bothers me to communicate with members of my team without interacting with them face-to-face" ($\alpha = .88$). This measure was also included in the pilot studies described above to validate the factor structure and reliability of the 5-item scale used in the current study. A CFA on the data from the current study in which items were loaded on a single factor showed good fit to the data [$\chi^2(5, N=193) = 7.70$, NNFI = .99, CFI = .99, SRMR = .02].

Virtual Teamwork Behaviors

The virtual teamwork behaviors variable was measured with 15 items that reflected behaviors that address the requirements for effective virtual teamwork derived from virtual team research. This approach follows existing research that has measured individual teamwork behaviors as a multidimensional construct consisting

of different dimensions of teamwork behavior (e.g., Barry & Stewart, 1997; Ellis et al., 2005; Hollenbeck, Moon, Ellis, Bradley, Ilgen, Sheppard, et al. (2002); McClough & Rogelberg, 2003; Morgeson et al., 2005; Neuman & Wright, 1999; Stevens & Campion, 1994, 1999). The virtual teamwork behaviors included in this scale were based on the requirements for virtual teamwork reviewed in Chapter 2 in relation to identifying virtual teamwork knowledge, skills, and abilities and comprise four dimensions of behaviors: communicating virtually, collaborating virtually across boundaries, building trust virtually, and individual self-management in a virtual team context. Hence, the items in the virtual teamwork behaviors scale included behaviors that describe communicating virtually (e.g., “Communicates virtually with team members in a way that is clear and easily understood,” 3 items), collaborating virtually across boundaries (e.g., “Is open to differences in ideas and approaches to the task among members of the team,” 3 items), building trust virtually (e.g., “Consistently meets task requirements,” 6 items), and individual self-management in a virtual team context (“Works independently to complete assigned tasks in the team,” 3 items). For each focal team member, 3-5 peers in the team were randomly selected to assess the extent to which the focal team member engaged in effective virtual teamwork behaviors. These peers were asked to rate the extent to which each behavior described the focal team member on a 7-point Likert scale ranging from 1 (*does not describe the team member well at all*) to 7 (*describes the team member extremely well*). Only those cases for which there were responses from at least two team members were included in the final sample. CFA on the virtual teamwork behaviors measure showed the four categories of behaviors as distinct factors [$\chi^2(84,$

N=1286) = 581.03, NNFI = .94, CFI = .95, SRMR = .03]. Coefficient alphas for the four dimensions were .92, .94, .95, .95 respectively. As expected, based on previous research, the virtual teamwork behavior dimensions were highly correlated (r between .85 and .94, $p < .01$). The reliability of the virtual teamwork behaviors multidimensional variable was assessed using Nunnally and Bernstein's (1994) approach for computing reliability of a multidimensional variable as the linear composite of the separate dimensions. The linear composite reliability was .98. The virtual teamwork behaviors variable was computed as the average score across each of the virtual teamwork behavior categories.

Attitude Toward Virtual Teamwork with the Team

Attitude toward virtual teamwork with the team was measured with 3 items adapted from Thom's et al.'s (1996) 5-item measure of attitude toward self-managing teams. The words "self managing teams" were replaced with "working virtually with my team." A sample item from this scale is "I feel positive about the virtual aspect of working with my team" ($\alpha = .87$).

Team Technology Support

Team technology support, the first moderator in the theoretical model, was measured with 3 items from Kirkman et al.'s (2006) measure of technology support. A sample item from this scale is "Our team has adequate technology for effective virtual collaboration" ($\alpha = .63$). The lower reliability of the measure relative to the other measures in the study is likely due to the fact that data from this scale was gathered from team leaders only with a sample size of 29.

Empowering Team Leadership

Empowering leadership, the second moderator, was measured using the five factor empowering leadership scale used by Srivastava et al. (2006). This scale is an abbreviated version of the scale developed and validated by Arnold et al. (2000) for measuring empowering leadership behaviors with five factors: leading by example (e.g., "Leads by example"), participative decision making (e.g., "Gives all team members a chance to voice their opinions"), coaching (e.g., "Teaches team members how to solve problems on their own"), informing (e.g., "Explains the team's goals"), and showing concern for/interacting with the team (e.g., "Shows concern for team members' success"). This abbreviated version of the scale contains 3-items for each of the factors. Specifically, team members indicated the extent to which statements describing empowering leadership behaviors described the leader of their team on a scale of 1 (*does not describe the team leader at all*) to 7 (*describes the team leader extremely well*). CFA on the empowering leadership measure showed the five dimensions as distinct factors [$\chi^2(80, N=186) = 210.98$, NNFI = .93, CFI = .95, SRMR = .04]. Coefficient alphas for the five dimensions were .87, .89, .81, .86, .89 respectively. As expected, based on underlying theory the empowering leadership dimensions were highly correlated (r between .74 and .88, $p < .01$). The reliability of the empowering leadership multidimensional construct was assessed using Nunnally and Bernstein's (1994) approach for computing reliability of a multidimensional variable as the linear composite of the separate dimensions. The linear composite reliability was .97. Following previous research, the five dimensions were averaged into the empowering leadership variable that was then used in the related analyses.

Contribution to Team Performance

Contribution to team performance was measured using two sub-scales from Welbourne, Johnson, and Erez's (1998) measure of role-based performance: job performance (doing things related to one's job description) and team performance (working with team members). The job performance role has also been referred to as task performance (Chen & Klimoski, 2003). Task and team performance are dimensions commonly assessed in studies of individual performance in teams, and have been found to be highly related in a team context (Morgeson et al., 2005; Stevens & Campion, 1999). This was also the case in the current study ($r = .90$, $p < .01$). The team leader rated the focal team member's contribution to the performance of the team on a 7-point scale ranging from 1 (*needs much improvement*) to 7 (*excellent*). The task performance sub-scale consisted of four items (e.g., "quantity of work output," and "quality of work output"), and the team performance sub-scale also consisted of 4 items (e.g., "working as part of a team," and "making sure the team succeeds"). CFA showed the two performance dimensions as distinct factors [$\chi^2(19, N=193) = 76.56$, NNFI = .94, CFI = .96, SRMR = .04]. Coefficient alphas for the two dimensions were .92 and .95 respectively. As expected based on existing research, the team performance and task performance variables were highly correlated ($r = .84$, $p < .01$). The reliability of the contribution to team performance multidimensional construct was assessed using Nunnally and Bernstein's (1994) approach for computing reliability of a multidimensional variable as the linear composite of the separate dimensions. The linear composite reliability was .97. The

three dimensions were averaged into the contribution to team performance variable that was then used in the related analyses.

Membership Viability

Membership viability was measured using two sub-scales that reflected important dimensions of viability defined in the literature (Hackman, 1987; Sundstrom et al., 1990). First, *team member satisfaction* was measured with 4 items adapted from Tesluk and Mathieu (1999), which they used to assess individual satisfaction in road work crews. The word “crew” was replaced by the word “team” for this study. A sample item from this sub-scale is “I really enjoy being a part of this team.” Second, *future willingness to work on the team* was measured using 3-items adapted from Tesluk and Mathieu (1999). The word “crew” in the original items was replaced by the word “team” for this study. A sample item from this sub-scale is “I would work with this team again in the future.” CFA showed the viability dimensions as distinct factors [$\chi^2(13, N=193) = 48.64$, NNFI = .93, CFI = .96, SRMR = .04]. As expected based on underlying theory, the team member satisfaction and future willingness variables were highly correlated ($r = .78, p < .01$). Following previous research, these two dimensions were averaged into the membership viability variable that was then used in the related analyses. The reliability of the membership viability multidimensional construct was assessed using Nunnally and Bernstein’s (1994) approach for computing reliability of a multidimensional variable as the linear composite of the separate dimensions. The linear composite reliability was .91.

Control Variables

Several variables were explored as potential controls at both the individual and team level. Only those that showed a significant relationship with the dependent variables in the model were carried forward in the analysis. At the individual level team member gender, age, number of other teams on which the team member simultaneously participated, and tenure on the team were all found to be unrelated to the dependent variables in the theoretical model. However, team member *virtual teamwork experience* was significantly related to the dependent variables in the model, and hence was included as an individual level control in the analysis. Consistent with the definition of experience as containing both quantitative and qualitative dimensions (Tesluk & Jacobs, 1998), the *virtual teamwork experience* scale consisted of two items that assessed the amount of experience collaborating virtually with others in teams and the extent to which that experience required a significant degree of communication and coordination between members of the team ($\alpha = .90$). The focal team member reported on his/her virtual teamwork experience on a 7-point Likert scale ranging from 1 (*no previous experience*) to 7 (*significant amount of experience*). At the team level, task interdependence and team size were considered as control variables but were not significantly related to the dependent variables in the model. However, the *type of team* (i.e., global commodity team or process improvement team) was significant and therefore included as a level 2 control. Commodity was coded as 0 and process improvement team was coded as 1. Information on the type of team was provided by the study coordinator in the organization and confirmed with the team leader.

Additional Confirmatory Factor Analysis

Confirmatory analysis was conducted to ensure adequate discrimination between the two self-report team member characteristics in the model: self-regulatory team orientation and preference for face-to-face communication with team members. CFA with each of the three self-regulatory team orientations and preference for face-to-face communication loaded on different factors and demonstrated good fit to the data [$\chi^2(269, N=193) = 544.45$, NNFI = .89, CFI = .89, SRMR = .06] and significantly better fit compared to a solution in which these variables were loaded on a single factor [$\chi^2(275, N=193) = 1310.45$, NNFI = .56, CFI = .60, SRMR = .13].

Chapter 4: Results

Analytic Approach

Due to the nested structure of the data (i.e., individuals nested within teams), hierarchical linear modeling (HLM) was used to test the hypotheses. The analytic approach used here is also sometimes referred to as random coefficient modeling (Bliese, 2002; Hofmann, 1997; Raudenbush & Bryk, 2002). HLM is a statistical approach that provides a more appropriate estimate of standard errors than other analytic methods when data are nested in teams and assumptions of independence, therefore, are not warranted. It takes non-independence within nested data into account by simultaneously partitioning and modeling within-group and between-group variance. In the HLM model, all variables were individual level variables (Level 1), with the exception of empowering team leadership and team technology support, which were designated as team level (Level 2) variables.

The analysis used the following procedure. First, for each dependent variable in the model, a *null* model was run to confirm that the use of HLM was appropriate. The null model has no predictors and is conceptually equivalent to a one-way analysis of variance in which group membership serves as the independent variable. The ICC(1) value resulting from this analysis reflects the percent of variance residing between teams. If the team level variance is significant then the use of HLM is warranted.

Second, the Level 1 direct effect relationships between team member characteristics and virtual teamwork behaviors, and also those between team member characteristics and attitude toward virtual teamwork were tested using HLM to

regress the behavior and attitude variables on their predictors. The cross-level moderating influences of team technology support and of empowering team leadership were then tested using ‘slopes-as-outcome’ models in which the slope estimates obtained from Level 1 analyses were regressed on the team level moderators. As a final step, the Level 1 direct relationships between virtual teamwork behaviors and team member outcomes (contribution to team performance and membership viability) were tested, as well as those between attitude toward virtual teamwork and team member outcomes. This was done by regressing each outcome variable on the behavior and attitude variables. The results of these analyses are described in the remainder of this chapter.

Preliminary Analysis

Aggregation Issues

The team level construct of empowering leadership required aggregation of multiple ratings from team members. Also, the individual level construct of focal team member virtual teamwork behaviors required aggregation of multiple ratings from peers. To justify aggregation for these scales, interrater agreement was calculated (James, Demaree, & Wolf, 1984). In addition, two intraclass correlations, ICC(1) and ICC(2), were also calculated. The ICC(1) refers to the proportion of the total variance accounted for by group membership and indicates whether raters/team members are replaceable. A one-way analysis of variance was used to confirm that a statistically significant proportion of the variance across individuals was accounted for by group membership (Bliese, 2000). Finally, the ICC(2) refers to the reliability of

the group level means, or whether average ratings in teams help differentiate between teams (Bliese, 2000).

For empowering leadership the values for median r_{wg} , ICC(1), and ICC(2) were .95, .09 ($F=1.67$; $p<.05$) and .40 respectively. These aggregation statistics are either within or only slightly below the acceptable range of values summarized in the literature (Bliese, 2000; James et al., 1984) and are comparable with other previously reported values (e.g., Schneider, White, & Paul, 1998). These values seemed to provide sufficient justification for aggregation, particularly when viewed in combination as suggested by Bliese (2000). For virtual teamwork behaviors the values of the aggregation statistics were .96, .11 ($F=1.67$; $p<.05$), and .25. Since the ICC(2) value is a function of group size and the ICC(1) value (Bliese, 2000), and the average group size used to calculate the virtual teamwork behaviors was 2.83, large ICC(2) values were not anticipated.

Descriptive Statistics

Descriptive statistics and bivariate correlations for all study variables are presented in Table 2. These correlations do not account for the non-independent nature of the data at the individual level, and hence should be viewed with caution until properly modeled using HLM.

Table 2

Descriptive Statistics and Bivariate Correlations for Study Variables^a

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Virtual teamwork KSAs	16.39	3.31	-									
2. Self-regulatory team orientation	5.67	0.68	-.12	-								
3. Preference for face-to-face communication with team	3.38	1.31	-.10	-.05	-							
4. Virtual teamwork behaviors	5.51	0.68	.04	.11	-.10	-						
5. Attitude toward virtual teamwork with team	5.34	0.89	.05	.29**	-.44**	.07	-					
6. Contribution to team performance	5.29	1.17	.18*	.13	.09	.46**	.13	-				
7. Membership viability	5.67	0.85	.05	.29**	-.12	.19**	.49**	.22**	-			
8. Virtual teamwork experience	5.74	1.21	.05	.12	-.14	.19*	.16*	.17*	.15*	-		
9. <i>Team technology support^b</i>	4.69	1.20	-.26**	-.08	-.10	.19*	.10	-.09	.12	.14	-	
10. <i>Empowering team leadership^b</i>	5.67	0.47	-.05	.08	.00	.29**	.13	.21**	.25**	.23**	.30	-
11. <i>Type of team (0=commodity; 1=process improvement)^b</i>	0.41	0.50	.10	.09	-.06	.28**	.06	.06	.11	.11	-.06	.23

^a These correlations should be viewed with caution since they do not account for the non-independent nature of the data at the individual level.

^b Level 2 variables are shown in italics. Correlations between Level 1 and Level 2 variables were calculated by assigning team level variables to the individual level.

* $p < .05$, ** $p < .01$

Hypothesis Testing

Results of HLM Null Models

Null models were run for each of the dependent variables in the model. Specifically, the null model provides estimates of the within- and between-group variance components of the dependent variable and provides a test of the significance of the Level 2 residual variance of the intercept (τ_{00}). The ICC(1) values and associated significance tests show significant between-group variance for virtual collaboration behaviors (27.45%, $\tau_{00} = .13$, $p < .001$), performance contribution (23.91%, $\tau_{00} = .34$, $p < .001$), and viability (9.27%, $\tau_{00} = .05$, $p < .05$). No significant between group-variance was found for the attitude toward virtual teamwork variable. Given the significant group level variance for three out of four of the dependent variables, I proceeded with the use of HLM to test the model relationships.

Effect of Team Member Characteristics on Virtual Teamwork Behaviors and Attitude Toward Virtual Teamwork with the Team

Table 3 summarizes the results of the analyses testing Hypotheses 1 and 2. Hypothesis 1 predicted that virtual teamwork KSAs would be positively associated with virtual teamwork behaviors, and Hypothesis 2 predicted that self-regulatory team orientation would be positively associated with virtual teamwork behaviors. To test these two hypotheses, experience with virtual teamwork was entered as a Level 1 control variable and team type as a Level 2 control variable in the model. The Level 1 predictors were also entered. Following common convention, the Level 1 predictors were grand mean centered (Kreft, de Leeuw, & Aiken, 1995; Liao & Chuang, 2004; Snijders & Bosker, 1999; Tangirala, Green, & Ramanujam, 2007). Results failed to

support Hypotheses 1 and 2. Neither the level of virtual teamwork KSAs nor self-regulatory team orientation was significantly associated with virtual teamwork behaviors.

Table 3

Results of HLM Analysis Testing Level 1 Direct Effect of Team Member Characteristics on Virtual Teamwork Behaviors^a

Predictors ^b	Coefficient (γ)	<i>t</i>
<i>Level 1</i>		
Virtual teamwork experience ^d	0.07	1.73
Virtual teamwork knowledge	0.02	0.79
Self-regulatory team orientation	0.06	0.87
R^2 ^c	.02	
<i>Level 2</i>		
Intercept	5.50	68.86***
Team type ^d	0.34	2.12*

^a N = 193 for individual level variables; N = 29 for team level variables

^b Level 1 predictors were grand-mean-centered.

^c R^2 value indicates the percentage of explainable within group variance in the Level 1 dependent variable accounted for by the level 1 predictors. This is calculated as follows: (total within-group variance per the null model – residual within-group variance after considering Level 1 predictors)/total within-group variance per the null model (Raudenbush & Bryk, 2002)

^d Entered as control variables

* $p < .05$

*** $p < .001$

Table 4 summarizes the results of the analyses testing Hypotheses 3 and 4. Hypothesis 3 predicted that self-regulatory team orientation would be positively associated with attitude toward virtual teamwork, and Hypothesis 4 predicted that

Table 4

Results of HLM Analysis Testing Level 1 Direct Effect of Team Member Characteristics on Attitude Toward Virtual Teamwork ^a

Predictors ^b	Coefficient (γ)	<i>t</i>
<i>Level 1</i>		
Virtual teamwork experience ^d	0.05	0.94
Self-regulatory team orientation	0.37	4.29***
Preference for face-to-face communication with team members	-0.26	-6.00***
R^2 ^c	.30	
<i>Level 2</i>		
Intercept	5.42	94.25***
Team type ^d	-0.10	-0.88

^a N = 193 for individual level variables; N = 29 for team level variables

^b Level 1 predictors were grand-mean-centered.

^c R^2 value indicates the percentage of explainable within group variance in the Level 1 dependent variable accounted for by the level 1 predictors. This is calculated as follows: (total within-group variance per the null model – residual within-group variance after considering Level 1 predictors)/total within-group variance per the null model (Raudenbush & Bryk, 2002)

^dEntered as control variables

*** $p < .001$

preference for face-to-face communication would be negatively associated with attitude toward virtual teamwork. As shown in Table 4, these hypotheses were supported. Self-regulatory team orientation was positively associated with attitude toward virtual teamwork (H3: $\gamma = .37, p < .001$), and preference for face-to-face communication was negatively associated with attitude toward virtual teamwork (H4: $\gamma = -.26, p < .001$).

Moderating Effect of Team Contextual Factors

Contextual factors were hypothesized to influence the nature of the relationship between team member characteristics (virtual teamwork KSAs and self-regulatory team orientation) and virtual teamwork behaviors. In other words, the contextual factors were predicted to be cross-level moderators of these Level 1 relationships. The hypotheses related to these cross-level moderating hypotheses were tested using “slopes-as-outcome” models, in which the team level contextual factor of interest was entered as a Level 2 predictor of the slope in each of the Level 1 relationships. The team member characteristic of interest and Level 1 control variable (virtual teamwork experience) were entered at Level 1. These Level 1 predictors were group mean centered to avoid potential confounds when testing for cross-level moderation (Enders & Tofighi, 2007; Hofmann & Gavin, 1998). The direct effects of the Level 2 control variable (team type) and the Level 2 predictor were entered at Level 2. These Level 2 variables were grand mean centered.

Table 5 shows the results of Hypothesis 5, which predicted that technology support would moderate the relationship between virtual teamwork KSAs and virtual teamwork behaviors. This hypothesis was not supported.

Table 5

Results of HLM Analysis Testing Moderating Effect of Team Technology Support on the Relationship between Virtual Teamwork KSAs and Virtual Teamwork Behaviors^a

Moderator Variable^b	γ	<i>t</i>
<i>Level 1 control</i>		
Virtual teamwork experience	0.08	1.79
<i>Level 2 controls</i>		
Intercept	5.48	73.59***
Team type	0.38	2.55*
Team technology support	0.16	2.34*
<i>Cross-level interaction</i>		
Intercept	0.02	1.27
Team technology support	0.00	0.08

^a N =193 for individual level variables; N = 29 for team level variables.

^b Level 1 predictor and control variables were group mean centered for testing cross-level moderating effect of team technology support. Level 2 variables were grand mean centered. Virtual teamwork experience and virtual teamwork KSAs were entered at Level 1. Team type and team technology support were entered as Level 2 control variables, predicting the intercept. Team technology support was entered as Level 2 variable predicting the slope.

*p <.05

*** p < .001

Table 6 shows the results of Hypothesis 6, which predicted that technology support would moderate the relationship between self-regulatory team orientation and virtual teamwork behaviors. Hypothesis 6 was also not supported.

Table 6

Results of HLM Analysis Testing Moderating Effect of Team Technology Support on the Relationship between Self-regulatory Team Orientation and Virtual Teamwork Behaviors^a

Predictors^b	γ	<i>t</i>
<i>Level 1 control</i>		
Virtual teamwork experience	0.09	1.92
<i>Level 2 controls</i>		
Intercept	5.48	73.59***
Team type	0.38	2.55*
Team technology support	0.16	2.34*
<i>Cross-level interaction</i>		
Intercept	0.00	0.01
Team technology support	0.08	1.18

^a N = 193 for individual level variables; N = 29 for team level variables.

^b Level 1 predictor and control variables were group mean centered for testing cross-level moderating effect of team technology support. Level 2 variables were grand mean centered. Virtual teamwork experience and self-regulatory team orientation were entered at Level 1. Team type and team technology support were entered as Level 2 control variables, predicting the intercept. Team technology support was entered as Level 2 variable predicting the slope.

*p < .05, *** p < .001

The results of the cross-level moderation analysis for empowering team leadership on the relationship between virtual teamwork KSAs and virtual teamwork behaviors (Hypothesis 7) are shown in Table 7. Hypothesis 7 was supported.

Table 7

Results of HLM Analysis Testing Moderating Effect of Empowering Team Leadership on the Relationship between Virtual Teamwork KSAs and Virtual Teamwork Behaviors^a

Predictors^b	γ	<i>t</i>
<i>Level 1 control</i>		
Virtual teamwork experience	0.08	1.93
<i>Level 2 controls</i>		
Intercept	5.46	75.64***
Team type	0.30	2.08*
Empowering team leadership	0.40	2.55*
<i>Cross-level interaction</i>		
Intercept	0.00	1.16
Empowering team leadership	0.09	1.93*

^a N = 193 for individual level variables; N = 29 for team level variables.

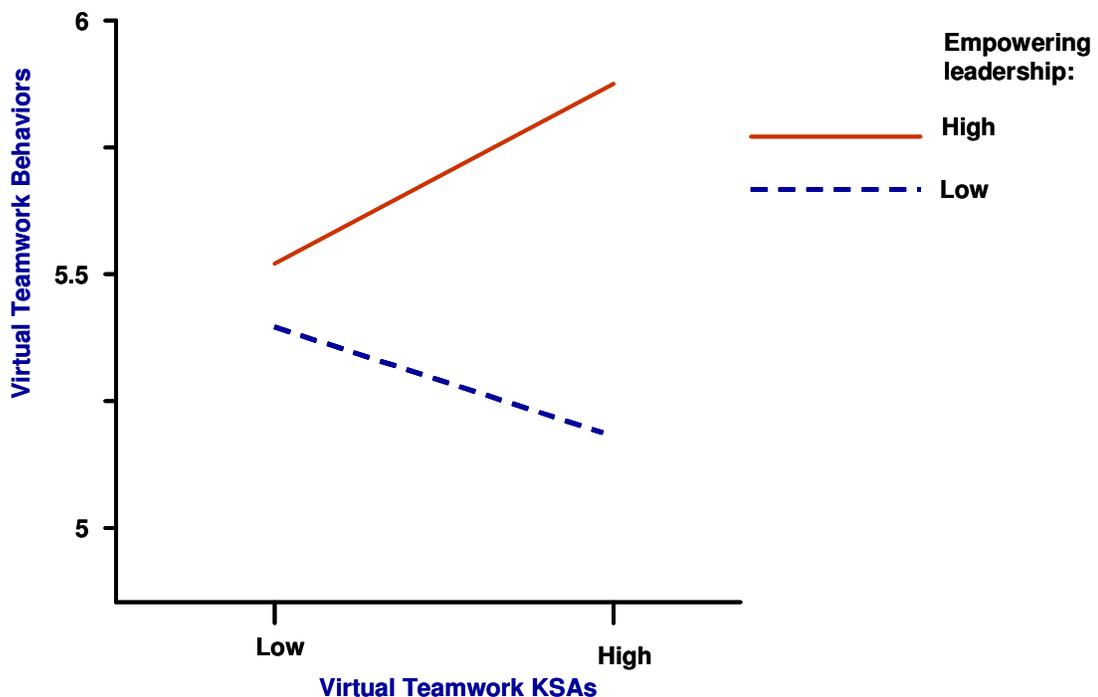
^b Level 1 predictor and control variables were group mean centered for testing cross-level moderating effect of empowering team leadership. Level 2 variables were grand mean centered. Virtual teamwork experience and virtual teamwork KSAs were entered at Level 1. Team type and empowering team leadership were entered as Level 2 control variables, predicting the intercept. Empowering team leadership was entered as Level 2 variable predicting the slope.

*p < .05, *** p < .001

Empowering team leadership positively moderated the relationship between virtual teamwork KSAs and virtual teamwork behaviors ($\gamma = .09, p < .05$). Figure 2 graphically shows this interaction at two levels of empowering leadership (i.e., + 1 standard deviation and -1 standard deviation). When empowering team leadership is high, virtual teamwork KSAs is positively related to virtual teamwork behaviors. When empowering team leadership is low, virtual teamwork KSAs is negatively related to empowering team leadership.

Figure 2

Moderating Effect of Empowering Team Leadership on the Relationship Between Virtual Teamwork KSAs and Virtual Teamwork Behaviors



As shown in Table 8, Hypothesis 8 was also supported. Empowering team leadership negatively moderated the relationship between self-regulatory team orientation and virtual teamwork behaviors ($\gamma = -.36, p < .05$).

Table 8

Results of HLM Analysis Testing Moderating Effect of Empowering Team Leadership on the Relationship between Self-regulatory team orientation and Virtual Teamwork Behaviors^a

Predictors^b	γ	<i>t</i>
<i>Level 1 control</i>		
Virtual teamwork experience	0.08	1.74
<i>Level 2 controls</i>		
Intercept	5.46	75.65***
Team type	0.31	2.09*
Empowering team leadership	0.40	2.54*
<i>Cross-level interaction</i>		
Intercept	0.06	0.75
Empowering team leadership	-0.36	-1.95*

^a N = 193 for individual level variables; N = 29 for team level variables.

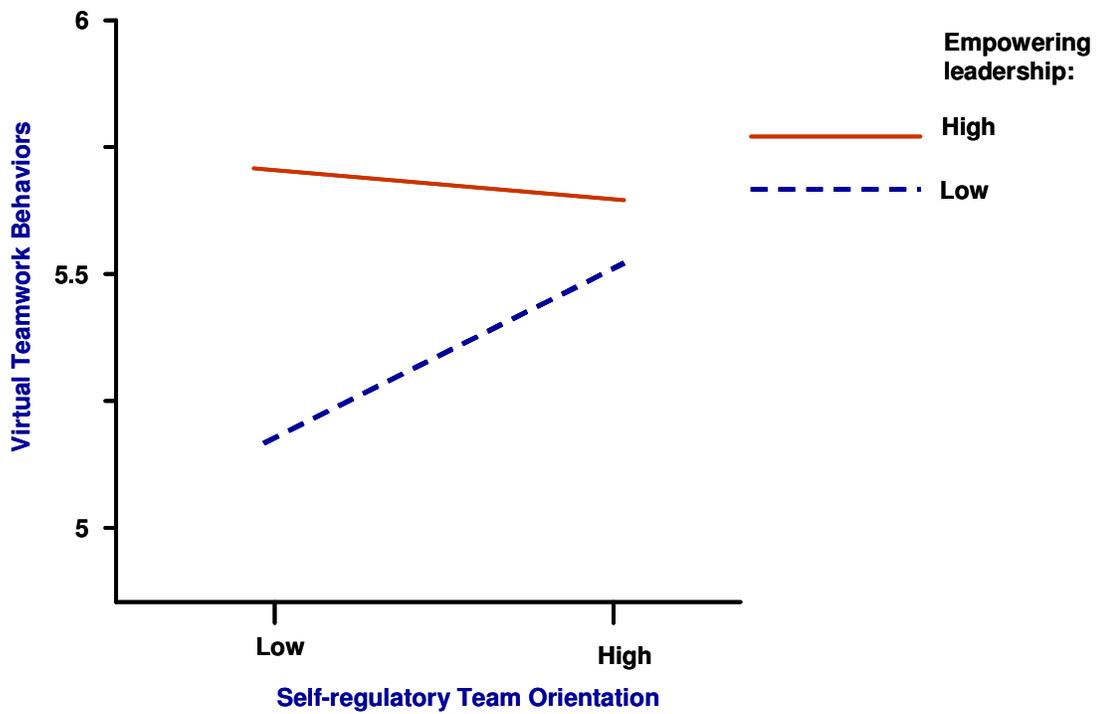
^b Level 1 predictor and control variables were group mean centered for testing cross-level moderating effect of empowering team leadership. Level 2 variables were grand mean centered. Virtual teamwork experience and self-regulatory team orientation were entered at Level 1. Team type and empowering team leadership were entered as Level 2 control variables, predicting the intercept. Empowering team leadership was entered as Level 2 variable predicting the slope.

* $p < .05$, *** $p < .001$

This interaction is shown in Figure 3 and shows that a positive relationship between self-regulatory team orientation and virtual teamwork behaviors only emerges when empowering team leadership is low.

Figure 3

Moderating Effect of Empowering Team Leadership on the Relationship Between Self-regulatory Team Orientation and Virtual Teamwork Behaviors



Effect of Virtual Teamwork Behaviors and Attitude Toward Virtual Teamwork on Team Member Outcomes

Table 9 shows the results of the analyses testing Hypothesis 9 and Hypothesis 10. Hypothesis 9 predicted that virtual teamwork behaviors would be positively associated with contribution to team performance, and Hypothesis 10 predicted that attitude toward virtual teamwork would be positively associated with contribution to team performance. To test these hypotheses, contribution to team performance was regressed on the Level 1 control variable (virtual teamwork experience), the Level 2 control variable (team type), and the two Level 1 predictors (virtual teamwork behaviors and attitude toward virtual teamwork). As shown in Table 9, Hypothesis 9 was supported. Virtual teamwork behaviors was positively associated with team contribution to team performance ($\gamma = .88, p < .001$). Also as shown in Table 8, Hypothesis 10 was supported. The relationship between attitude toward virtual teamwork and contribution to team performance was significant ($\gamma = .18, p < .05$).

Table 9

Results of HLM Analysis Testing Level 1 Effect of Attitude Toward Virtual Teamwork with Team and Virtual Teamwork Behaviors on Contribution to Team Performance^a

Predictors ^b	Coefficient (γ)	<i>t</i>
<i>Level 1</i>		
Virtual teamwork experience ^d	0.07	0.84
Virtual teamwork behaviors	0.88	6.13***
Attitude toward virtual teamwork	0.18	1.97*
R^2 ^c	.26	
<i>Level 2</i>		
Intercept	5.31	42.53***
Team type ^d	-0.34	-1.39

^a N = 193 for individual level variables; N = 29 for team level variables

^b Level 1 predictor variables were grand mean centered for testing Level 1 effects.

^c R^2 value indicates the percentage of explainable within group variance in the Level 1 dependent variable accounted for by the level 1 predictors. This is calculated as follows: (total within-group variance per the null model – residual within-group variance after considering Level 1 predictors)/total within-group variance per the null model (Raudenbush & Bryk, 2002)

^d Entered as control variables

*p <.05

*** p < .001

Using a procedure similar to that used to test Hypotheses 9 and 10, but with membership viability as the dependent variable, results showed (Table 10) that

Hypothesis 11 was also supported. Virtual teamwork behaviors was positively associated with membership viability ($\gamma = .18, p < .05$). Finally, Table 10 also shows that Hypotheses 12 was supported. Attitude toward virtual teamwork was positively associated with membership viability ($\gamma = .46, p < .001$).

Table 10

Results of HLM Analysis Testing Level 1 Effect of Attitude Toward Virtual Teamwork with Team and Virtual Teamwork Behaviors on Membership Viability^a

Predictors ^b	Coefficient (γ)	<i>t</i>
<i>Level 1</i>		
Virtual teamwork experience ^d	0.06	1.32
Virtual teamwork behaviors	0.18	2.04*
Attitude toward virtual teamwork	0.46	7.43***
R^2 ^c	.27	
<i>Level 2</i>		
Intercept	5.72	89.75***
Team type ^d	0.08	0.64

^a N = 193 for individual level variables; N = 29 for team level variables

^b Level 1 predictor variables were grand mean centered for testing Level 1 effects.

^c R^2 value indicates the percentage of explainable within group variance in the Level 1 dependent variable accounted for by the level 1 predictors. This is calculated as follows: (total within-group variance per the null model – residual within-group variance after considering Level 1 predictors)/total within-group variance per the null model (Raudenbush & Bryk, 2002)

^dEntered as control variables

* $p < .05$, *** $p < .001$

Chapter 5: Discussion and Conclusion

The purpose of this study was to identify characteristics that are important for virtual teamwork and mechanisms through which they influence a virtual team member's contribution to team performance and membership viability (team member satisfaction and future willingness to work with the team). The study findings show that a team member's characteristics related to virtual teamwork influence the extent to which the team member engages in effective virtual teamwork behaviors, and holds a positive attitude toward working virtually with his or her team. In addition, virtual teamwork behaviors and attitude toward virtual teamwork are positively associated with contribution to team performance and membership viability. These findings have important theoretical and practical implications. These implications are discussed below, along with the study limitations and suggestions for future research.

Theoretical Implications

This dissertation makes several important theoretical contributions. One important contribution is that it responds to the need that has been identified by virtual team researchers to identify attributes of team members who are more likely to be successful in virtual teams (Axtell et al., 2004; Furst et al., 1999; Hertel et al., 2005; Martins et al., 2004; Powell et al., 2004; Webster & Staples, 2006).

Researchers have noted the almost exclusive focus on the group level of analysis in the emerging research related to virtual teams, and stressed the need to focus on individuals in the team (Blackburn et al., 2003; Duarte & Snyder, 2001; Furst et al., 1999; Powell et al., 2004; Shin, 2004). The implications of this research need has

been described as “profound for managers” (Furst et al., p. 257) and essential for selecting and developing individuals best suited for virtual team membership. This dissertation identifies characteristics that uniquely address the requirements for teamwork in a technology-mediated environment. These include virtual teamwork knowledge, skills and abilities (KSAs); self-regulatory team orientation; and preference for face-to-face communication with team members.

Each of the individual characteristics examined in this research provide important additions to the virtual team literature. First, although researchers have proposed virtual teamwork KSAs (e.g., Blackburn et al., 2003), this research goes beyond the more general descriptions currently offered in the literature to describe specific aspects of four categories of virtual teamwork KSAs that allow assessment using a situational judgment test. Virtual team researchers have argued that the KSA requirements identified for traditional teamwork (e.g., Stevens & Campion, 1994) provide neither sufficient alignment with nor sufficient coverage of KSA requirements for virtual teamwork (Furst et al., 1999; Powell et al., 2004). Given that, the virtual teamwork KSAs identified in this study provide a useful foundation for future research in this area.

Second, unlike most research that examines the influence of broad personality traits, such as the big five (Costa & McCrae, 1985), on team member performance (e.g., Barry & Stewart, 1997; Morgeson et al., 2005; Neuman & Wright, 1999), this study examined the influence of self-regulatory team orientation or stable behavioral tendencies related to team-focused self-regulation. Orientations have been shown to mediate the relationship between broader personality traits, such as the big five

(Costa & McCrae, 1985) and behaviors in a specific context (Allport, 1961; Brown, Mowen, Donovan, & Licata, 2002; Eysenck, 1947; Harris, Mowen, & Brown, 2005; Liu & Chen, 2006; McFarland & Kidwell, 2006; Mowen & Spears, 1999; Parker et al., 2006; Paunonen, 1998). Researchers have therefore argued that they are more proximal predictors of context-specific behaviors. A focus on behavioral tendencies also facilitates the use of selection techniques, such as behavioral interviewing. Future research might identify additional dimensions that comprise a self-regulatory team orientation, beyond the three dimensions identified in this study.

Finally, although lack of face-to-face communication is a defining characteristic of a virtual team (Kirkman & Mathieu, 2005), surprisingly there is little research that specifically examines individual characteristics that might influence a virtual team member's reaction to communicating using technology, as opposed to face-to-face. By examining the influence of preference for face-to-face communication as a virtual team member characteristic, this research provides an important new direction for virtual team research. Future research might explore antecedent characteristics that lead to preference for face-to-face communication with team members. Research that has linked personality characteristics (e.g., extraversion; Topi et al., 2002) and national culture characteristics (Downey et al., 2005; Straub et al., 1997) to reactions to different media use can be a useful starting point.

It might also be useful to adapt the preference for face-to-face communication construct to understand individual responses in other types of technology-mediated work arrangements, beyond virtual teams. For example, technology-mediated

communication is a defining characteristic of e-learning, telecommuting, and e-mentoring; hence, preference for face-to-face communication is likely to play an important role in outcomes related to these types of work arrangements. Finally, future research might also explore the impact of other preferences related to team member interaction in virtual teams on virtual team member outcomes. For example, there is research to show that individuals vary in their preference for working through problems together with others using approaches, such as group brainstorming; as opposed to working alone to process information before interacting with others (Sternberg, 1997). This preference is likely to be important for virtual team members, given that a technology-mediated work environment results in lower levels of interaction with other team members in completion of work tasks (Workman et al., 2003)

Beyond identifying team member characteristics that are germane to virtual teamwork, another important contribution of this dissertation is the finding that contextual factors interact with individual characteristics to influence the extent to which team members engage in virtual teamwork behaviors. Many researchers have observed that context is often unrecognized or underappreciated in organizational research (Capelli & Sherer, 1991; Johns, 2006), and in teams research in particular (Morgeson et al., 2006). With regard to virtual teams, three recent reviews of the virtual team literature all noted the lack of research examining the role of context (Axtell et al., 2004; Martins et al., 2004; Webster & Staples, 2006).

Despite the recognized importance of context, my review of the existing research that has examined the role of individual characteristics in teams showed that

these studies have typically not incorporated contextual factors. This research shows the importance of considering contextual factors to better understand the conditions under which team member characteristics have their effect on virtual team member outcomes. The hypothesized positive relationships between virtual teamwork KSAs and virtual teamwork behaviors failed to emerge until the team leader's leadership style was also taken into account. When empowering team leadership is high, this creates conditions in which virtual teamwork knowledge can be effectively applied in the team. Hence, the study findings showed that under conditions of high empowering team leadership the relationship between virtual teamwork KSAs and virtual teamwork behaviors was more positive. This finding is in line with existing research that has shown the importance of context in facilitating the transfer of teamwork KSAs into positive results for virtual teams (e.g., Kirkman et al., 2006).

Empowering team leadership was also found to moderate the relationship between self-regulatory team orientation and virtual teamwork behaviors. When empowering team leadership is high, this creates a condition of heightened intrinsic motivation in the team that triggers effective team processes and compensates for low self-regulatory team orientation on the part of a team member (Chen & Kanfer, 2006; Chen et al., 2007). Hence, the relationship between self-regulatory team orientation and virtual teamwork behaviors was weaker when empowering team leadership was high. This important interplay between individual level and team level motivational forces has also been demonstrated in other recent research (Chen et al., 2007). Chen and Kanfer proposed that team level and individual level motivation processes in

teams might interact and called for more research to uncover the nature of these interactions.

These results also shed light on the important role of virtual team leader behaviors, and specifically empowering leadership. Researchers have made theoretical arguments for why empowering leadership behaviors might play an important role in a virtual teamwork environment (Bell & Kozlowski, 2002), and shown empirically that team empowerment results in greater virtual team effectiveness (Kirkman et al., 2004). However, there is a lack of research that examines how empowering leadership behaviors exhibited by virtual team leaders influence behaviors and performance on the part of team members. Researchers have cautioned against the blind assumption that factors that influence face-to-face teams are valid for virtual teams (Kirkman et al., 2004; Potter & Balthazard, 2002). This current study shows that the positive effects of empowering leadership in facilitating effective interactions among team members (Srivastava et al., 2006) observed in more traditional teams has similar effects in a virtual team. Also, although not presented as a formal hypothesis, it is interesting to note that empowering team leadership also had a direct effect on team member virtual teamwork behaviors. This indicates that empowering team leadership is also an important contextual factor for promoting virtual teamwork performance directly. These findings take an important step in advancing research related to leadership in virtual teams, an area that has received limited research attention (Powell et al., 2004).

Future research might also explore the other direct effects of context on team member behaviors. For example, team technology support also had a direct positive

cross-level relationship with virtual teamwork behaviors. A number of other contextual factors that have been examined in virtual team research are likely to also directly influence team member virtual teamwork behaviors. These include contextual factors not only related to the team, but also to the task environment and the team member's local work environment. The fact that the type of team was significantly related to the dependent variables in the model, suggests that future research might fruitfully explore how the nature of the team task influences individuals' behaviors in a virtual team and responses to virtual teamwork. Potential factors related to a team member's local work environment that might be explored are organizational culture (Suchan & Hayzak, 2001; Zack & McKenney, 1995), reward systems (Hertel, Konradt, & Orlikowski, 2004; Lurey & Raisinghani, 2001), and local team member work demands (Klein & Kleinhanns, 2003).

The final important contribution of this research is the study of outcomes beyond performance. While existing research has examined the relationship between a team member's characteristics and his or her teamwork behaviors (e.g., Barry & Stewart, 1997; Neuman & Wright, 1999; Stevens & Campion, 1994) and contribution to team performance (e.g., Barry & Stewart), there is a lack of empirical research that examines the impact of individual characteristics on outcomes beyond performance. Yet, virtual team researchers have suggested that a focus on these outcomes is particularly important in virtual teams because the challenges of collaborating in a technology-mediated environment is likely to negatively impact team member satisfaction and other affective outcomes (for reviews, see Axtell et al., 2004; Martins et al., 2004; Powell et al., 2004; Raghuram et al., 2001).

The utility of focusing on affective responses to virtual teamwork is clearly shown by the finding that attitude toward virtual teamwork, as well as virtual teamwork behaviors, was positively associated with the team member outcomes examined in the study. Specifically, the findings showed that in addition to the significant interactions discussed above between virtual teamwork KSAs and empowering team leadership, and between self-regulatory team orientation and empowering team leadership, to influence virtual teamwork behaviors, team member characteristics also influenced attitude toward virtual teamwork. There was a positive relationship between self-regulatory team orientation and attitude toward virtual teamwork, and a negative relationship between preference for face-to-face communication and attitude toward virtual teamwork. The results further showed that virtual teamwork behaviors and attitude toward virtual teamwork were both positively related to contribution to team performance and membership viability.

The focus on membership viability in this study is also an important extension of existing research related to individual outcomes in teams. Viability has long been recognized as a critical component of team level effectiveness (Hackman, 1987; Sundstrom et al., 1990). Further, two dimensions of team viability are team member satisfaction and future willingness to work with the team (Sundstrom et al., 1990). In examining individual team member outcomes in a team, it is therefore important to understand influences on the viability of an individual's membership in the team (team member satisfaction and future willingness to work with the team), which in the aggregate contributes to team viability (Tesluk & Mathieu, 1999).

Interestingly, the study findings failed to support the predicted moderating influence of team technology support on the relationships between team member characteristics and virtual teamwork behaviors. The lack of any significant findings might be related to the way in which technology support was measured. The team leader was asked to rate the level of technology support available to the team. In a virtual team where team members are not co-located, the team leader might not have total knowledge of local challenges that team members face related to technology support. As a result, it might have been more appropriate to measure technology support at the individual level. In virtual teams, where each team member is located in a different local context, researchers will need to consider carefully the appropriate level of conceptualization and measurement of contextual factors. Further research is needed to shed light on this important question.

Managerial Implications

This research makes a significant contribution to management practice. Many organizations are not taking a proactive approach to helping their employees be effective virtual team members (Rosen et al., 2006). The research findings suggest that an organization that is willing to invest in selecting, training, and providing support for virtual team members will reap the benefits in terms of increased team member performance, satisfaction, and willingness to continue working virtually. These findings should be of particular interest to organizational leaders whose business strategies (e.g., outsourcing and globalization) rely on the successful implementation of virtual teams.

Perhaps one of the reasons for the lack of a more proactive approach on the part of organizations is that there is little research to guide organizations in selecting and developing virtual team members. The research presented here takes several important steps forward in providing such guidance. First, the virtual teamwork KSAs identified in the study can form the basis for virtual team member training on how to work effectively with others in a virtual teamwork environment. However, organizations should also take note that training alone will not necessarily yield better outcomes if team members are not adequately empowered to apply these KSAs when working with team members.

Second, the orientation and preference identified in this research can be used by human resources practitioners, where possible, to select individuals that more naturally exhibit the work behaviors and preferences required for effective virtual teamwork. In fact, the findings suggest that it is particularly important to have team members who are inclined to engage in virtual teamwork behaviors if leadership in the team is not empowering. Conversely, for existing teams, where members may lack the requisite behavioral tendencies to drive effective virtual teamwork behaviors, empowering team leadership may provide some compensation. For the best results, organizations should focus both on selecting and developing team members as well as providing the right team leadership.

Given the important role played by virtual teamwork behaviors and attitude toward virtual teamwork in shaping positive outcomes for virtual team members, organizations may wish to take steps to promote these behaviors and positive attitudes among members of virtual teams. For example, it might be possible to encourage

team members to conduct peer assessments and give each other feedback on their virtual teamwork behaviors. This could identify important areas for improvement and team member training needs. Leaders should also be encouraged to establish norms of behavior for their team that include the virtual teamwork behaviors in this study. These norms could be reviewed with team members at the launch of the team and then continually reinforced through coaching. In addition, it would be worthwhile for organizations to monitor team member attitudes toward virtual teamwork, for example, as part of periodic employee surveys.

Limitations and Future Research Directions

One limitation of this research is the relatively small sample size of 29 teams that might have limited the power to detect significant effects. However, that notwithstanding, it is encouraging that many of the study hypotheses were supported. However, future research using larger team samples would be advantageous. In particular, research that allows the causal relationship between the variables to be established would be helpful. The current study was cross-sectional, which makes it impossible to verify causal relationships. Although, it seems logical that individual characteristics drive behaviors and attitude, it is possible, for example, that the outcomes from past virtual teamwork experiences also influence behaviors and attitudes related to working virtually. Indeed, the Input-Mediator-Output-Input model, which provided the underlying framework for this research, specifically allows for this type of feedback loop. In this model, the second *I* represents the notion that outputs, such as the ones examined in this research, can be inputs to future behaviors or processes and emergent states. An area for future research is to specifically

examine how experiences working virtually relate to future virtual teamwork outcomes. This could be accomplished, for example, by longitudinal studies that track the progress of team members in newly formed teams.

Future longitudinal studies will also allow a closer examination of the extent to which the relationships specified in the theoretical model change over the lifecycle of the team. For example, the role of trust might be particularly important in the early stages of team development but become less important as a team becomes more established. Given this, it is possible that the importance of certain team member characteristics could change over time.

A second limitation of this study was the fact that team virtuality was not included as a variable in the model. Data gathered prior to the study showed that the teams did not vary widely in terms of their reliance on technology or types of technologies used. As a result it was not possible to determine to what extent team virtuality moderated the hypothesized relationships. In addition, the study design did not allow a comparison with more traditional (less virtual) teams. Hence, although I can claim based on the results of this study that the virtual teamwork characteristics are important for outcomes in highly virtual teams, no claim can be made regarding the degree to which these characteristics explain more variance in individual outcomes in more virtual teams versus less virtual teams. Future research is needed to examine this question. The fact that the teams were similar in level of virtuality and team members operated under similar conditions suggests that team members have been used to dealing with a similar type of virtual teamwork environment, and may therefore have acquired a similar level of KSAs learned through their experience

working in the teams. This might have resulted in some range restriction on the variance of some of the individual characteristics in the model.

Finally, the purpose of this research was to identify individual characteristics that influence individual level performance in virtual teams. However, this leaves open the question of how these individual findings relate to team level outcomes. Future research would be helpful to link team member outcomes to objective measures of team performance. Similarly, it would be useful to examine how individual characteristics combine at the team level to influence team performance. For example, past traditional team research has examined the influence of mean team member teamwork KSAs (Hirschfeld et al., 2006; Miller, 2001) and variance in team member teamwork KSAs (Miller, 2001) on team level performance. Researchers have also examined the influence of different configurations of team member personality on team level outcomes (Barry & Stewart, 1997; Neuman & Wright, 1999). Research is needed to determine the best combination of virtual team member characteristics to achieve high levels of virtual team performance. Related to this, research that studies the characteristics of team leaders that lead to effective team performance would be another worthwhile avenue for future research.

Conclusion

Research has shown that organizations are failing to take full advantage of their virtual team investments (Rosen et al., 2006). Only by understanding the characteristics that make individuals successful in a virtual team, can organizations select, develop, and manage employees in order to maximize team member outcomes. I hope that this dissertation research will take a substantial step toward advancing

research in this area, and that it will positively impact the success of virtual team implementations in organizations.

Appendix 1: Study Measures

Virtual Teamwork Knowledge Test

(Items 3, 18, and 22 were deleted for the analysis because of their low biserial correlations.)

The following questions describe situations involving virtual collaboration with others. Please answer each question by selecting the best response to the given situation. Some alternatives may be partly correct, so you should read all the answers and select the one that you think is best.

1. You are involved in a phone discussion with a virtual team member from another country. The purpose is to develop ideas for solutions to a problem that the team is experiencing. Every time you suggest an idea, the other team member seems critical of the idea. You do not understand this behavior. What is the **best** immediate next step to take in this situation?

- Tell the team member how you feel, and suggest that he/she be less critical.
- Complete the discussion and try to avoid working with that team member directly in the future.
- Based on your knowledge of that team member and the situation, try to assess why he/she is acting that way.
- At the next team meeting, stress that it is important that team members not be critical of each other.

2. You have sent a report that you have written to members of your virtual team to ask for their feedback. On the date the feedback is due, you have heard back from only 3 out of 6 of your virtual team members. In addition, only 1 of the 3 that responded provided relevant feedback. What would be the **best** action to take?

- Use the feedback you have received to finalize the report and send the final version out to the team.
- Send another request for feedback to the team members and give them more time to provide you with their input.
- Send another request for feedback but include information about which items have the highest priority.
- Contact each team member who failed to provide appropriate feedback to see if your request was received and understood.

3. You have written a project report for your virtual team. You now wish to gather final changes from the other team members in order to complete the report. What is the **best** media to use to gather team members' input?

- Phone
- Video Conference
- Email

- Instant Chat

4. There have been some complaints in your virtual team regarding slow responses to requests made by team members. As a result, the team leader has set a goal for team members to respond to requests from each other within 24 hours. What is the **best** next step to ensure that you perform well in this area?

- Check in with your team members periodically to find out if you are meeting this goal.
- Monitor how long it takes you to respond to team member requests
- Assess whether you think the 24 hour response time is realistic.
- Wait to see if other team members complain about your response time.

5. Which of the following is **most** true regarding trust in virtual teams, where team members have less face-to-face interaction, compared to trust in traditional face-to-face teams?

- In a virtual team, developing trust between team members is less important for good team performance.
- In a virtual team, trust between team members is more difficult to destroy once it has been developed.
- In a virtual team, trust between team members is more related to how much personal information you share with the team.
- In a virtual team, trust between team members is more difficult to develop.

6. You have set a performance goal for your task in your virtual team. Which is the **best** action to take if your performance is not where it should be?

- Reward yourself for good effort, even if the goal is not reached.
- Set lower goals in the future that you have a greater likelihood of reaching.
- Critically evaluate the reasons for your poor performance.
- All of the above are good actions to take.

7. In which of the following situations would it be **best** for you to suggest a face-to-face meeting with a member of your virtual team?

- You are approaching an important deadline for which you and the team member are jointly responsible.
- You are working on an important task for which you need the team member's input.
- You and the team member are located relatively close to each other and could get together without lengthy travel.
- You and the team member are trying to resolve a complex problem with no clear solution.

8. Which of the following is **most** effective for promoting trust in a virtual team?

- Maintaining a consistent focus on schedules and deadlines so that you meet your obligations.
- If you fail to meet your commitments, making sure that other team members understand the reason why.
- Staying closely within the bounds of what you have agreed to do, even if the situation changes.
- Getting on with your work without seeking a lot of input from others.

9. You have been asked to work on a project for your manager with a virtual team member who is in another workgroup in the organization. The team member makes a suggestion for the project that shows you that she does not understand how things work in your group. What is the **best** action to take in this situation?

- Politely describe why the idea will not work for your group
- Look for some part of the idea that you could implement without too many problems
- Discuss the idea further to see if there are aspects of the idea that could be further developed
- Promise to consider the idea, then send an email after a few days to describe why it would not work

10. In virtual teams, there is less interaction with a team leader or other team members. As a result, what is the **best** strategy if you are not performing well on your assigned tasks?

- Contact the team leader to ask for direction on how to improve your performance.
- Gather feedback to identify behaviors that are contributing to your poor performance and develop a plan to improve.
- Implement suggestions made by team members to assess their usefulness.
- Assess the performance of other team members to understand how your performance compares with theirs

11. Your virtual team consists of members from several different functional backgrounds (engineering, marketing, sales, human resources). You disagree with other members of the team on an important issue. You suspect that this is a result of differences in your functional backgrounds. What is the **best** action to take?

- Not bring it up if it is going to disturb the peace and harmony in the group.
- Discuss it with one or two team members who you feel you can confide in
- Discuss it with one or two people who are not on the team to obtain their advice about how to proceed
- Raise the concern and constructively ask the team to consider ways to resolve it.

12. You have received a request from a virtual team member for help with a problem related to his assigned task in the team. Which of the following criteria would be **most** important in deciding what priority to give this request?

- The impact on the team's schedule if the task is delayed
- The visibility of the task to the team leader
- The level of difficulty of the task
- All of the above would be equally important

13. What would be the **best** type of goals to set for yourself in order to ensure that you maintain high levels of performance in your virtual team?

- Goals to "do your best"
- Specific goals that are challenging
- Goals that are easy to achieve
- General goals that can be adjusted as needed

14. You are working in a virtual team with members who are very different from each other (e.g., cultural, functional differences). This results in different opinions about how to approach the team's task. Which of the following is the **best** strategy to follow?

- Clearly assert your different views and positions so that everyone on the team knows where you stand.
- Focus on team member similarities and try not to bring too much attention to differences.
- Seek out the various team members' perspectives to benefit from differences in the team.
- Focus only on those differences that can be easily reconciled so that the team can build confidence in working together

15. When working on a virtual team, which of the following types of information would be **least** important to share with other members of your team?

- Whether you work from home or an office
- Local holidays in your location
- Percent of time available to work on the team
- How you are evaluated by your manager for your work on the team

16. Your virtual team holds regular conference calls to discuss status and problems in the team's project. Which of the following behaviors would be **most** important if you want to earn the trust of the team?

- Ask team members for their suggestions to solve a task-related problem you are experiencing
- Try to start each conference call with small talk before moving on to the task
- Steer clear of subjects that might lead to disagreements in the team

- Demonstrate your expertise by contributing useful ideas to the team

17. You are working on a task with another virtual team member. You disagree on how the task should be done. Which of the following is the **best** strategy in this situation?

- Ask the team leader to provide a solution
- Seek the perspective of someone who is impartial and not in the team
- Get other team members' perspective on the best solution
- Take the time to work with the team member to collaboratively develop a solution

18. Which of the following is the **best** strategy for communicating in virtual teams?

- Send the entire team regular updates about progress on your activities.
- Send the entire team updates only when there is a problem they need to be aware of.
- Send updates to individual team members who you think will be most interested in your current activities.
- Send updates only when requested to do so.

19. On a conference call, members of your virtual team have been asked to report any problems that they think the team ought to know about. No one raises any issues. Later that day, after the call, you find out that one of the team's members has experienced some problems. Furthermore, these problems cause a delay in a task to which you are assigned. You don't understand why the team member did not raise this important issue on the conference call for the team to discuss. What is the **best** immediate next step for you to take under these circumstances?

- Send an email to the team member expressing your disappointment about the failure to raise this issue and making sure the team member understands the problem this has created.
- Contact the team member to get more information about the situation before deciding what to do
- Report to the team leader, since clearly the team member is trying to hide his/her poor performance.
- Contact the team member's supervisor to pressure the team member into sending the deliverable on time.

20. Which of the following communication strategies is **most** important for building positive relationships with members of your virtual team?

- Provide prompt and detailed feedback in response to team member requests for input
- Share a large amount of personal information with other team members
- Make sure that team members know how happy you are to be on the team

- All of the above are equally as important

21. The team leader and other team members in your virtual team are located in very different locations and time zones. This results in delays in communications among people in the team. You encounter a problem in your area of expertise, which if not addressed immediately, could create a significant delay in the team's schedule. What is the **best** course of action in this situation?

- Solve the problem and inform the team
- Ask for direction from the team leader on how to solve the problem
- Poll the other team members for suggestions on how to resolve the problem
- Develop a solution, but act only after sending out to the rest of the team for review and feedback

22. When sending messages to their virtual team members via email some people use additional strategies, such as punctuation to emphasize a point, highlighting to draw attention, and symbols to denote humor and other moods and feelings. Which of the following statements is **most** correct about these communication strategies?

- They are generally distracting to those receiving the communication and make it less effective
- They are generally recommended for helping to improve understanding of the communication
- They generally make no difference to the effectiveness of the communication
- They are only necessary when team members come from different cultural backgrounds

23. You and another virtual team member strongly disagree on an approach to one of the team's tasks. What would be the **best** media for communicating with this team member to resolve this issue?

- Email
- Phone
- Instant Chat
- Any of the above would work well – select the one that is most convenient

24. Your virtual team has collaborated on the development of a final project report. The report has been sent to all team members for final review. You notice that an important section, related to an area with which you are familiar, has been overlooked by the team. What is the **best** action to take?

- Bring it up for discussion at the next team meeting.
- Check in with a few team members to see what they think should be done.

Draft the missing section, and distribute it to your team members for review and feedback

Contact the team leader to have the missing section assigned to someone on the team

25. You are having a disagreement with another member of your virtual team. The disagreement is based on a fundamental difference in how things are done in the different groups to which you both belong. What would be the **best** way to resolve this situation?

Agree to a compromise that both of you could accept.

Respectfully present the merits of each idea so that the best one can be selected

Get more information about each other's position to develop solutions that both of you like.

Suggest that you each give something up in order to resolve the conflict.

26. One of your virtual team members sends you an angry email. In it she accuses you of making a decision that negatively impacts her. Which of the following is **most** true regarding the use of email to respond to this team member?

Email is a **poor** choice because it creates a permanent record of the discussion

Email is a **poor** choice because people tend to be less inhibited when using email

Email is a **good** choice because it allows you to take the emotion out of the discussion

Email is a **good** choice because it allows you to keep the team leader copied on the communication

27. When working in a team some people like to take the initiative to solve problems and volunteer to take the leadership role for tasks in their area of expertise. Which of the following statements is **most** true regarding the use of these behaviors in a virtual team?

They are generally not recommended because they tend to make other team members reluctant to volunteer for tasks.

They are generally not recommended because they tend to cause you to be perceived as dominating the team.

They are generally only recommended for teams that have worked together for some time.

They are generally recommended because they tend to promote higher levels of trust with members of the team.

28. You have just joined a virtual team in which the major form of communication is email. Which of the following **best** represents an important factor to keep in mind as you send out emails to members of the team?

- A good rule to follow is to resend an email if the intended receiver has not replied within 24 hours.
- Receivers of negative email messages are likely to misinterpret them as more intensely negative than intended by the sender.
- Emails sent out near the end of the work day are likely to receive the most attention by receivers.
- Copying everyone on the team on all messages that go between any pair of team members is a good way to keep all team members informed.

Unless otherwise specified, all the remaining variables were measured by responses to the following questions on a 7-point Likert scale: “To what extent do you agree with the following statement? (1=*strongly disagree*, 2=*disagree*, 3=*slightly disagree*, 4=*neutral (neither agree or disagree)*, 5= *slightly agree* 6=*agree*, 7=*strongly agree*)”

Self-regulatory Team Orientation

When I am in a team, I tend to...

Perceptual Orientation

- ... pay attention to what is behind my actions when working with others in the team.
- ... be aware of the effects of my actions in the team.
- ... be patient with team members who act in ways I do not understand.
- ... pause instead of immediately reacting when a team member does something that bothers me.
- ... try to look beyond what people say to get as many clues as possible to explain their behavior.
- ... look at the context to help me interpret what is happening if a team member does something I do not understand.
- ... be open to other team members’ different ways of doing things.
- ... see things from the other person’s perspective if I have disagreements with members of my team

Initiative Taking Orientation

- ... initiate actions to overcome obstacles in the team.
- ... take the lead to solve problems that arise in the team.
- ... exercise leadership to make the team more effective.
- ... demonstrate initiative to keep things moving.
- ... take the initiative for tasks within the team.
- ... take action to fix a problem I notice.

Self-management Orientation

- ... set personal goals for my own performance in the team.
- ... monitor my own progress toward the goals I have set for myself in the team.
- ... critically evaluate my own performance in the team.
- ... track my own actions to ensure that I stay on track with my tasks in the team.
- ... plan for myself how I will perform an important task in the team before I actually do it.
- ... map out expectations for myself related to my work in the team.

Preference for Face-to-Face Communication

1. When communicating with team members, I always prefer to meet with them face-to-face
2. It bothers me to communicate with members of my team without interacting with them face-to-face
3. It is important to me to be face-to-face when communicating with members of my team
4. Face-to-face communication is generally the only way to communicate effectively in a team
5. I believe that communicating with team members without face-to-face interaction is generally a bad idea

Virtual Teamwork Behaviors

“Rate the extent to which the following statements describe this team member (*1= does not describe team member very well at all; 7= describes team leader extremely well*).

Communicating Virtually

1. Uses technology effectively to communicate virtually with team members
2. Communicates virtually with other team members in a way that is clear and easily understood
3. Takes steps to avoid misunderstandings when communicating virtually with team members (e.g., by providing important background information, verifying receipt of messages, requesting and providing clarification)

Collaborating Virtually Across Boundaries

4. Works well with team members from diverse backgrounds (suspends judgment, tries to understand different behaviors and perspectives)
5. Is open to differences in ideas and approaches to the task among members of the team

6. Constructively resolves conflict with other team members

Building Trust Virtually

7. Shows initiative in working with the team (assumes leadership for tasks and for helping the team resolve problems.)
8. Keeps team members informed of progress and issues
9. Sends virtual communications with a positive, encouraging tone
10. Encourages the team to stay focused on the task (e.g., to establish plans and schedules, coordinate the team's work)
11. Provides detailed and useful input and feedback to other team members when requested
12. Consistently meets task requirements

Individual Self-Management in a Virtual Team Context

13. Sets own goals and objectives, including high personal performance standards
14. Displays a high degree of self-management (manages assigned tasks effectively without a lot of supervision)
15. Works independently to complete assigned tasks in the team

Attitude Toward Virtual Collaboration With Team

1. I like collaborating virtually with my team
2. I feel positive about the virtual aspect of working with my team
3. I am happy about working virtually with the members of my team

Team Technology Support

1. Our team has access to adequate technology for effective virtual collaboration.
2. The team's performance when working virtually would greatly improve if the team as a whole had better access to virtual collaboration technologies.
3. The team has ready access to the right technologies to make virtual collaboration in the team relatively easy.

Empowering Team Leadership

“Rate the extent to which the following statements describe the leader of this team (1= does not describe the team leader very well at all; 7= describes team leader extremely well).

Leading by example

1. Sets high standards for performance by his/her own behavior.
2. Leads by example.
3. Sets a good example by the way he/she behaves.

Participative decision making

1. Encourages team members to express ideas/suggestions.
2. Uses the team's suggestions to make decisions that affect us.
3. Gives all team members a chance to voice their opinions.

Coaching

1. Helps the team identify areas in which we need more training.
2. Teaches team members how to solve problems on their own.
3. Supports the team's efforts.

Informing

1. Explains the team's goals:
2. Explains the purpose of the company's policies to the team.
3. Explains rules and expectations to the team.

Shows Concern/Interacting with the team

1. Shows concern for team members' well-being.
2. Takes the time to patiently discuss team members' concerns.
3. Shows concern for team members' success.

Team Member Contribution to Team Performance

Please think about the team member's contribution to the performance of the team. Then provide input regarding the team member's contributions using the scale below. (1=needs much improvement; 7=excellent).

Task Performance

1. Quantity of work output
2. Quality of work output
3. Accuracy of work output
4. Customer service provided (internal and external)

Team performance

1. Working as part of a team or work group
2. Seeking information from others in his/her work group
3. Making sure his/her work group succeeds
4. Responding to the needs of others in his/her work group

Membership Viability

Satisfaction with the Team

1. I really enjoy being a part of this team
2. I feel like I get a lot out of being a member of this team
3. I get along with the members of this team
4. I am very happy being part of this team

Willingness to Engage in Future Collaboration with the Team

1. I would work with this team again in the future
2. I would want to work with a team that has mostly the same people again
3. For future projects, I would hope to be with a different team (reversed)

Virtual Teamwork Experience

Thinking about your experience related to working with others in a virtual team, please describe the amount of experience you have had using the following scale: (1 = No previous experience; 7 = Significant amount of experience)

My experience collaborating virtually...

...with others in teams

...on tasks that require a significant degree of communication and coordination between members of the team.

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