

DISSERTATION

VIRTUALLY ENGAGED: THE EFFECT OF A VIRTUAL WORK ENVIRONMENT
ON TASK ENGAGEMENT, ITS ANTECEDENTS, AND CONSEQUENCES

Submitted by

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In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Summer 2011

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ABSTRACT

VIRTUALLY ENGAGED: THE EFFECT OF A VIRTUAL WORK ENVIRONMENT ON TASK ENGAGEMENT, ITS ANTECEDENTS, AND CONSEQUENCES

As organizations continue to adopt virtual work environments in an effort to reduce costs and offer employees greater flexibility, the effect of this work setting on employee engagement is not fully understood. This laboratory study investigates the effect of a virtual work environment on participant perceptions ($N = 242$) of engagement, its antecedents, and consequences in an effort to extend the Job Demands-Resources model of employee engagement (JD-R; Bakker & Demerouti, 2007). Specifically, it was proposed that the JD-R be expanded to include contextual variables (e.g., work environment) and that these variables potentially influence individuals' appraisals of whether a work variable is a resource or a demand. To test this modified model, participants were assigned to work on a marketing task in either a virtual ($N = 126$) or co-located environment ($N = 116$). Results revealed that task engagement, quality of coworker relations, social presence, task performance, and task satisfaction were all higher and team uncertainty was lower for those working in a co-located environment compared to those working virtually. Team uncertainty and social presence partially mediated the relationship between work environment and quality of coworker relations. Team uncertainty was higher and social presence was lower for those working virtually

as compared to those who were co-located, which in turn resulted in perceptions of reduced quality of coworker relations. Furthermore, task engagement fully mediated the relationship between quality of coworker relations and both performance and effort, and task engagement partially mediated the relationship between quality of coworker relations and task satisfaction. Quality of coworker relations was positively related to task engagement, which was related to increased task performance, effort, and task satisfaction. When combined, the results provide support for the proposed expansion of the JD-R to include contextual variables. Because resources and demands are fundamental to the JD-R and determine when employees become engaged versus disengaged, this extension to the model makes a significant contribution to the employee engagement and virtual work literatures. These results also offer practical applications for those organizations that operate virtual work environments.

ACKNOWLEDGEMENTS

This work would not have been possible without the help and support of those around me. I want to thank Dr. Zinta Byrne, my advisor, for her incredible guidance and encouragement throughout this project and all the milestones along the way. I would also like to thank the members of my dissertation committee, Dr. Kurt Kraiger, Dr. Michael Steger, and Dr. Jennifer Cross, for their invaluable feedback and commitment to this project.

I am also grateful for the incredible team of research colleagues who helped make this data collection possible. I would like to thank Josh Liff for his collaboration on this and other research projects and to our incredible research team, including Ryan Amaya, Ashley Meek, Cammie Karr, Ryan Tollis, Andrew Chun, Amy Vermillion, Alexa Wooderson, Erin Cohan, Chelsea Danielson, Amber Love, Brittany Pletcher, John Schumacher, Dawnelle Schlagel, Megan Verros, and Kimber Welton. This project would not have been completed without their enthusiasm and commitment.

Finally, I would like to extend a heartfelt thank you to my colleagues for challenging me and to my family and friends for motivating me. To my family, Kristin and Carolyn, thank you for your never-ending love and support. You both give me the inspiration to achieve our dreams.

DEDICATION

This dissertation is dedicated to my parents, Stephen and Carol (1948-1999).
Your love and encouragement has made me into the person I am today. Thank you for
teaching me to work hard, to be kind, and to follow my passion for learning.

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INTRODUCTION

Over the last decade, the availability of new communication technologies, together with the need to lower operating expenses and offer employees greater flexibility, has led to an increased organizational adoption of virtual work environments. A recent report by the Dieringer Research Institute revealed that 33.7 million Americans teleworked in 2009, an increase of 43 percent since 2005 (ITAC, 2009), and other reports have found that one-half to two-thirds of employees at many large organizations work on virtual teams at any given time (DeRosa & Lepsinger, 2010; Nunamaker, Reinig, & Briggs, 2009). That number could grow significantly over the next several years as organizations seek new ways to reduce costs and attract superior talent. For example, in November 2010, the U.S. Congress approved legislation that would allow federal employees to work virtually as a way for the government to “save money, increase productivity, and have an easier time recruiting and retaining good (employees)” (Davidson, 2010, p. 1). Such virtual work, which refers to when employees communicate and perform all or part of their work from a location that is physically separated from the location of their coworkers, has many demonstrated advantages including high employee productivity, low absenteeism, low organizational overhead, and low turnover rates (for a review see Bailey & Kurland, 2002; Baruch, 2000; Gajendran & Harrison, 2007).

Though organizations are increasingly adopting virtual work environments, this potentially has implications for employee engagement, a growing emphasis in today’s workplace. Organizations expect their employees to be energetic and dedicated, apply

their full abilities to their work, and be committed to high-quality performance; that is, they expect their employees to be engaged (Bakker & Leiter, 2010). However, data suggest that there exist a large number of employees who are not engaged. Specifically, there have been reports that disengaged employees are costing U. S. businesses an estimated \$300 billion a year in lost productivity (Bates, 2004; Johnson, 2004; Kowalski, 2003). With such staggering figures, researchers and organizational leaders alike are working to understand how to prevent their employees from being disengaged.

Kahn (1990), in his seminal paper on employee engagement, emphasized that psychological presence at work was a necessary condition for engagement, but with the growth in virtual communication, the question arises as to whether *physical* presence also matters and whether physical absence at work has a negative effect on engagement.

Although there has been an increasing amount of research on engagement at work (see Bakker & Leiter, 2010), no theoretical or empirical work to date has focused on whether employees working in a virtual environment experience less engagement because they are not physically present at work as compared to employees who work co-located with their coworkers and managers. Therefore, given the growth in virtual communication and the increasing need for the engaged worker, the question arises whether both psychological presence and physical presence are required for employees to be engaged.

The purpose of the current study is to understand whether physical presence, in the form of a co-located work environment, is a factor that enables employees to become engaged during a task. To date, contextual variables such as physical presence have not been considered in models of employee engagement. One widely-used engagement model where physical presence may be incorporated is the Job Demands-Resources

model (JD-R; Bakker & Demerouti, 2007). This model proposes that coworker relations (namely social support) are a resource that functions as a positive antecedent to engagement. I propose a theoretical expansion to the JD-R model that incorporates work environment as a distal predictor. This expansion suggests that physical presence affects how job demands and resources are perceived, perceptions which in the JD-R model are critical in determining whether an employee becomes engaged or disengaged. Based on this theoretical expansion, I will empirically examine whether a virtual work environment (i.e., lack of physical presence) diminishes the quality of coworker relations, which in turn negatively affects engagement and its outcomes including task performance, effort, and task satisfaction (see Figure 1 for a model of the current study).

The findings of the study will have both theoretical and practical implications. Theoretically, this study will extend the JD-R model by addressing the question of whether physical presence should be included in models of employee engagement and if work environment is a distal variable that affects performance, effort, and task satisfaction through its effects on engagement. The practical implications of the results may be to provide information about specific features of the work environment hinder or enable task engagement for employees who work virtually. This information may be useful in designing tasks for virtual workers. The next sections provide the background for the proposed expansion of the JD-R model and the development of the study to test the new expansion.

Employee Engagement

Research on engagement in organizations has focused on how people employ and express themselves during role performance and the factors that enable employees to

bring their full potential to their job. Although engagement has been studied for over two decades, there is still debate among researchers and practitioners on the definition of the construct itself (e.g., Leiter & Bakker, 2010; Macey & Schneider, 2008; Schaufeli & Bakker, 2010). For example, much of the first issue of the journal *Industrial and Organizational Psychology: Perspectives on Science and Practice* was devoted to a discussion about the definition, meaning, and scope of employee engagement. In that issue, Macey and Schneider documented various definitions of engagement and proposed a new framework that defined engagement as an all-inclusive term containing three separate, though related, types of engagement: behavioral, trait, and state.

Behavioral Engagement

According to Macey and Schneider (2008), behavioral engagement includes the assumption that employees have a limited reservoir of energy, and as a result demonstrate discretionary effort and behaviors beyond what is typically expected or demanded by the work role. Such behaviors include personal initiative (Crant, 2000) and organizational citizenship behaviors (Organ, 1988). Other researchers (e.g., Dalal, Brummel, Wee, & Thomas, 2008; Leiter & Bakker, 2010) have criticized this component of Macey and Schneider's three-part framework, stating that behavioral engagement actually refers to *outcomes* of engagement, not to a separate type of engagement.

Trait Engagement

Macey and Schneider (2008) proposed that trait engagement is an individual difference variable describing employees' predisposition to experience their work in positive, active, and energetic ways that leads them to demonstrate behavioral engagement. Macey and Schneider suggested that trait engagement includes a variety of

inter-related constructs including positive affectivity, conscientiousness, proactive personality, and autotelic personality. They view this type of engagement as a distal predictor of work outcomes (e.g., job performance) and likely to interact with situational factors (such as work attributes including task variety or autonomy) to determine state or behavioral engagement. Furthermore, this view of trait engagement holds that engagement, in general, is not focused on any particular object, event, or individual, but is instead a general tendency for employees to be engaged across situations.

State Engagement

Whereas trait engagement is a conceptualization of work engagement as a relatively stable characteristic of employees, state engagement is centered on short-term fluctuations in the experience of employee engagement (e.g., feeling absorbed in the current work), thus explaining why an individual feels more engaged within certain work contexts and not others (Sonnentag, Dormann, & Demerouti, 2010). Using this short-term, contextual perspective, researchers focus on proximal predictors of work engagement, rather than on stable individual difference characteristics and the effects that immediate antecedents have on outcomes of engagement.

Task work engagement. Researchers examining state engagement have found that an individual's level of state engagement can vary over a short period of time, across tasks, and is dependent upon a number of factors (Dalal, Brummel, Wee, & Thomas, 2008). For example, in a diary study using public service employees, Sonnentag (2003) found that employee engagement on a task fluctuated substantially within individuals over the course of the five-day study and that 42 percent of the overall variance in reported engagement was at the within day (individual) level. Other researchers have

shown that daily changes in social support affect the work engagement among flight attendants (Xanthopoulou, Bakker, Heuven, Demerouti, & Schaufeli, 2008) and fast-food workers (Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009), providing further support that engagement levels vary across contexts.

Sonnentag et al. (2010) proposed a model of state work engagement wherein the variation of within-person engagement is not random and can be explained by a number of related factors. Specifically, they proposed that there are distal day-level processes (e.g., opportunity to recover from previous work; Sonnentag, 2003) and day-level job resources (e.g., job autonomy, social support, and supervisor behavior) that affect state engagement. These processes and resources shape state work engagement, which in turn affects work outcomes such as job performance, proactive behavior, strain, and work-life conflict (Sonnentag et al., 2010). This model is particularly relevant when considering the potential effects of work conditions, such as comparing virtual versus co-located work, because work conditions may be considered day-level processes that potentially affect perceptions of day-level job resources. Thus, work conditions may be most closely related to task work engagement as opposed to behavioral or trait engagement.

Approaches to the Study of Engagement

Because the proposed model hypothesizes that a virtual work environment has an effect on employee engagement, the focus here is on state engagement, rather than trait or behavioral engagement. In the extant engagement literature (for a review see Shuck & Wollard, 2010), there have been two main approaches to studying state engagement, each with its own theoretical model and mechanism of measurement: 1) Kahn's (1990)

framework of physical, cognitive, and affective engagement, and 2) Schaufeli and Bakker's (2004) framework of vigor, dedication, and absorption.

Kahn's engagement framework. Kahn (1990) was the first scholar to conceptualize engagement as a unique construct. He described work engagement as the "harnessing of organizational members' selves to their work roles: in engagement, people employ and express themselves physically, cognitively, and emotionally during role performances" (p. 694). This holistic approach to engagement can be described as a multidimensional, motivational construct that reflects the simultaneous investment of personal physical, cognitive, and emotional energy into work performance. Engaged individuals, according to Kahn (1992), are psychologically present, cognitively vigilant, attentive, and emotionally connected to their work and to others.

To date there have been only a few studies that have empirically tested Kahn's (1990) model. May, Gilson, and Harter (2004) used Kahn's conceptualization of engagement and found that experienced meaningfulness, psychological safety, and availability of resources were positively tied to engagement. In a more recent study, Rich, LePine, and Crawford (2010) developed and validated a new measure of employee engagement using Kahn's conceptualization of physical, cognitive, and affective components, and they found that engagement predicted both task performance and organizational citizenship behavior.

Schaufeli and Bakker's engagement framework. A second approach to examining employee engagement began with the notion that engagement is the antithesis of burnout (Maslach, Schaufeli, & Leiter, 2001). From this perspective, engagement is characterized by three facets (energy, involvement, and efficacy) that represent the

opposite of the core burnout dimensions exhaustion, cynicism, and inefficacy, respectively (Maslach & Leiter, 1997, 2008). Finding difficulties with the distinctiveness of the engagement factors as opposites of burnout, Schaufeli and colleagues (Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002) further extended the burnout/engagement perspective by considering engagement as an independent, distinct construct that is negatively related to burnout, rather than its opposite.

This approach defines engagement as a positive, work-related state of fulfillment characterized by a high level of vigor, dedication, and absorption (Schaufeli et al., 2002). Vigor refers to a willingness to invest effort and energy into one's work and the resilience to persist in the face of challenges (Gonzalez-Roma, Schaufeli, Bakker, & Lloret, 2006). Dedication refers to experiencing a sense of involvement, pride, enthusiasm, and significance with one's work (Schaufeli & Bakker, 2004). Absorption is being fully engrossed in and enabling full concentration in one's work. A state of optimal absorption has been referred to as "flow," characterized by focused attention, effortless concentration, loss of self-consciousness, and distortion of time (Csikszentmihalyi, 1990). It should be noted that vigor, dedication, and absorption are all experiences of work activity that describe an engaged state; they are not predictors or outcomes of these experiences. The most widely-utilized measure of this conceptualization of engagement is the Utrecht Work Engagement Scale, which measures these three components of engagement (Schaufeli & Bakker, 2003, 2010).

Both Kahn's (1990) and Schaufeli and Bakker's (2004) frameworks are motivational conceptualizations of engagement, where there is an allocation of personal resources to role performance, and both describe the intensity and persistence of behavior

required to bring one's full potential to the job. Additionally, each model includes a behavior-energy component, a cognitive component, and an emotional component. The frameworks differ in that whereas Kahn emphasizes the cognitive connection to one's work role, Schaufeli and Bakker emphasize the emotional and energetic connection to one's work role. Because Kahn's approach reflects a more holistic view of engagement than Schaufeli and Bakker's, in that it is not inherently tied to the stress literatures, the current study will adopt Kahn's definition of engagement.

Related Relationships between Engagement and Other Constructs

Over the past two decades, relationships between employee engagement and other organizational constructs have been explored, and such relationships provide initial support for the framework proposed in the current study. Specifically, in a study on antecedents and consequences of employee engagement, Saks (2006) found that work factors such as perceived organizational support, job characteristics, and procedural justice were all significant predictors of engagement. He further found that engagement mediated the relationships between these antecedents and a number of work outcomes, including job satisfaction, organizational commitment, intentions to quit, and organizational citizenship behavior. In a recent meta-analysis, Halbesleben (2010) used Schaufeli and Bakker's (2004) conceptualization of engagement and found that social support, autonomy, feedback, positive organizational climate, and self-efficacy were all positively related to vigor, dedication, and absorption. Additionally, these facets of engagement were also related to work outcomes such as organizational commitment, job performance, health-related outcomes (e.g., physical health conditions, sleep quality, reported stress), and turnover intention. The implications of the findings of both studies

are that the work environment plays a role in establishing employee engagement, and that engagement appears to be related to a number of important work outcomes at the organizational, group, and employee levels.

A Model of Virtual Work and Employee Engagement

Although it was originally developed as a model of burnout (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), the Job Demands-Resources (JD-R) model was modified to explain employee engagement (see Bakker & Demerouti, 2007; Schaufeli & Bakker, 2004) and has been one of the most commonly examined models of engagement. Specifically, this model proposes a dual process in which engagement is the outcome of the combination of job demands and available job resources.

The first process focuses on how job demands exhaust and overtax an employee's ability to perform. Job demands include physical, psychological, social, or organizational aspects of a job that require attention and response from the employee. Examples of job demands include role ambiguity, role overload, supervisor or coworker conflict, and adverse physical work conditions (Schaufeli & Bakker, 2004). Over time, these demands may evoke strain and may lead to chronic fatigue and even burnout.

The second process is one in which psychological, social, organizational, and physical resources enable goal achievement, counteract against job demands, and enable growth and development (Bakker & Demerouti, 2008; Schaufeli & Salanova, 2007). Employee resources exist at the organizational level (e.g., salary, career opportunities, job security), interpersonal level (e.g., supervisory coaching and social support from colleagues), and task level (e.g., performance feedback, skill variety, and autonomy; Halbesleben, 2010). Whereas a lack of resources has been found to lead to burnout and

reduced work engagement (Bakker, Demerouti, & Verbeke, 2004; Schaufeli & Bakker, 2004), the availability of job resources has been argued to be the exclusive predictor of employee engagement (Mauno, Kinnunen, & Ruokolainen, 2007; Schaufeli & Bakker, 2004). Job resources are intrinsically motivating because they foster growth and development, and they have been tied to the fulfillment of basic human needs including belongingness, competency, and the need for autonomy (DeCharms, 1968; Van den Broeck, De Witte, Lens, & Vansteenkiste, 2008). Resources are also extrinsically motivating because they create an environment wherein employees are able to achieve their work goals (e.g., through supervisor support or task feedback).

Based on empirical studies of the JD-R model, Bakker and Demerouti (2008) recently proposed a modification to the JD-R model to clarify this dual process even further. Specifically, they proposed that job demands moderate the relationship between resources and engagement. That is, when job demands are high, the relationship between job resources and engagement is more salient than when demands are low. Job resources become more important in fostering engagement when job demands are high and when resources can counter the negative effects of job demands on the employee.

Additionally, consistent with recent empirical studies (Halbesleben, 2010; Saks, 2006; Schaufeli & Bakker, 2004), this revised model proposed that employee engagement mediates the relationship between job resources and organizational outcomes including job performance, organizational commitment, retention, and health-related outcomes (see also Hakanen, Bakker, & Schaufeli, 2006; Hakanen & Roodt, 2010; Schaufeli & Bakker, 2004). Unincorporated in the JD-R model, however, is the notion of the virtual work

environment, which may alter how employees perceive components of their job as either a job demand or as a resource.

JD-R Model and a Virtual Work Environment

New communication technologies have enhanced our ability to connect employees across space and time, thus enabling individuals and groups to interact beyond their immediate physical surroundings in a virtual environment. A virtual work environment refers to a work context in which employees use technology to communicate with their employers and coworkers who are not physically located at the same location (Martins, Gilson, & Maynard, 2004; Townsend, DeMarie, & Hendrickson, 1998). A co-located work environment, in contrast, refers to an environment in which employees work in the same physical location as their employers and coworkers (Ahuja & Gavin, 2003).

Research in virtual work shows that some employers actually prefer co-located work environments. For example, in a recent survey, 760 business executives reported that they preferred co-located over virtual meetings when decision-making and persuasion were required (Forbes, 2009). Additionally, 86 percent of respondents said they felt that engagement among their employees was higher when they were co-located and working together as opposed to when they met virtually. Although technology can help organizations save money and time and allow for flexibility, the executives preferred face-to-face meetings because they believed the face-to-face connection facilitated building stronger, more meaningful business relationships with coworkers and clients, and co-located meetings allowed employees to read body language and facial expressions (Whitehead, 2010).

For these surveyed executives, the core benefit in co-located work was social interaction. The JD-R model, however, does not consider contextual variables beyond the resources and demands that may affect employee engagement. Thus, even though past research shows that the meaningful connection between coworkers derived from a co-located work environment may contribute to employees perceiving coworker relations as a job resource, the JD-R model cannot account for co-located versus virtual work contexts. Thus, I propose that the nature of the work environment (i.e., working co-located or working virtually) is an additional factor beyond resources and demands that affects engagement and its outcomes, and, therefore, must be incorporated in the JD-R model of employee engagement.

Furthermore, the JD-R model suggests that the categorization of job resources versus demands is based on some initial absolute criteria rather than on the perceptions of the variables themselves by the employees. For example, Schaufeli and Bakker (2004) operationalized job demands using a measure of workload that asked items which were primed as a demand such as “my job required working very hard” (p. 302) with a frequency scale of *never* to *always*. Resources were operationalized as support and coaching and included measurement items such as “I receive sufficient information...” and “can you ask your colleagues for help” (p. 302) again on the same frequency scale of *never* to *always*. By asking the questions in this way and by using a frequency scale for responding, Schaufeli and Bakker do not ask for employees’ perceptions of whether a variable is a resource or demand but instead the authors have already determined specific variables that fall into either category. Therefore, the study participant is simply providing perceptions of how much of the demand or resource he or she is subject to or

receives. I propose that the work environment, namely being physically present with coworkers (i.e., co-located) or not (i.e., virtual), affects how employees perceive the variables themselves as either job resources or demands. Specifically, I focus here on coworker relations, a component of jobs that has most frequently been operationalized as a resource.

Quality of Coworker Relations and Employee Engagement

Coworker relations has been one of the most commonly studied antecedents among employee engagement researchers (Halbesleben, 2010) and is included as an antecedent in the JD-R Model (Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2007). Within the JD-R model, coworker relations are critical resources that can enhance employee engagement (Hakanen & Roodt, 2010; Halbesleben, 2010), and in support, positive work interactions have been shown to lead to feelings of invigoration among employees (Shirom, 2010). Besides sources of emotional support and knowledge, colleagues can reduce isolation and enhance engagement at work (Wiesenfeld, Reghuram, & Garud, 2001). This reduction in feelings of isolation contributes to high levels of perceived support in work groups whereby those individuals reporting high levels of social support have been shown to be more cohesive and goal directed. This, in turn, leads to higher morale and task performance (Karasek & Theorell, 1990; Terry, Carron, Pink, Lane, Jones, & Hall, 2000) as compared to those reporting low levels of social support. Furthermore, Kahn (1990) noted that individuals experience psychological meaningfulness (a precursor to engagement) when their task performances include rewarding interpersonal interactions with coworkers and clients (see also Alderfer, 1985). Such rewarding interpersonal interactions with coworkers can be

intrinsically motivating and result in a greater pride and meaningfulness at work as well as extrinsically motivating because they are instrumental in achieving work goals (Meijman & Mulder, 1998).

Although this research demonstrates how interpersonal relations among coworkers foster engagement, these studies have not considered how the work environment (e.g., a virtual work setting) might negatively affect perceptions of coworker relations, resulting in diminished engagement. As evidence, Golden (2007) studied the effect of telework on coworker relations and found that increased telework at an organization was negatively related to satisfaction with coworkers. This relationship between prevalence of teleworking and satisfaction with coworkers was moderated by the extent of face-to-face interactions, the amount of time coworkers spent teleworking, and job autonomy. Interactions through electronic media are not as fulfilling as face-to-face interactions because of decreased feelings of involvement and limited personal contact available through electronic media (Rice, 2003; Rice & Gattiker, 2001). In contrast, a high number of face-to-face interactions has been linked to deep shared understanding and trust (Leenders, Van Engelen, & Kratzer, 2003), good coordination and cooperation with coworkers (Andres, 2002), and few team conflicts. It has been suggested that these face-to-face interactions allow for the ability to easily identify and resolve potential conflicts before they escalate (Hinds & Mortensen, 2005; Kiesler & Cummings, 2002), an ability not as easily available to those in virtual environments. Based on the virtual teams and computer-mediated communications literature, I extend the JD-R model by proposing that the perceived quality of coworker relations will be higher in a co-located environment than in a virtual work environment.

Hypothesis 1: Those working in a virtual environment will report lower quality of coworker relations compared to those working in a co-located environment.

Beyond finding a main effect, it is also important to understand why differences may exist in quality of coworker relations between virtual and co-located work environments. Kahn (1990) suggested that individuals' perception of their work context directly influences their willingness to personally engage in work roles. Therefore, the current study will test whether coworker relations can be considered both a demand and a resource depending on the work environment (Lazarus & Folkman, 1984). I hypothesize that a positive relationship between physical presence and quality of coworker relations is due to reduced team uncertainty and increased social presence in a co-located work environment. Together, I believe these two variables will explain why work environment is related to quality of coworker relations.

Team uncertainty. Team uncertainty refers to the perception of the absence of shared task or interpersonal information among team members (Achrol, 1988). That is, when information seems lacking between team members, they become uncertain about how other members feel about them and lack the ability to make sense of their current environment (see social information processing theory; Salancik & Pfeffer, 1978). Researchers have shown that team uncertainty is higher in virtual teams than in co-located teams (Tangirala & Alge, 2006). Higher levels of uncertainty have been linked to increased ambiguity of messages (Langan-Fox, 2002), fewer shared perceptions and meaning of work, reduced understanding of other team members, and a lack of information about the context in which coworkers function (Cramton, 2001). In contrast, co-located team members can communicate their feelings more readily via facial

expressions and other mechanisms of communication not available in virtual environments (Hurd & Byrne, 2010), which results in greater information shared and reduced uncertainty among coworkers.

Therefore, it is proposed that the increased uncertainty of a virtual environment is one reason why quality of coworker relations is lower for those working virtually than it is for those in a co-located work environment. In other words, it is believed that team uncertainty will partially mediate the relationship between work environment and quality of coworker relations. Work environment has been shown to determine levels of team uncertainty (e.g., Tangirala & Alge, 2006), and high levels of team uncertainty can degrade or inhibit positive coworker relations (e.g., Cramton, 2001). For those working in a virtual work environment, it is partly because of increased team uncertainty that they have reduced quality of coworker relations compared to those working co-located that have greater team certainty and, as a result, more positive perceptions of quality of coworker relations. Partial mediation is proposed instead of full mediation because there may be features of the work environment that have a direct effect on quality of coworker relations, or alternatively, indirect effects through other variables not specified in the current study. Thus, rather than assuming that all the variance in quality of coworker relations can be explained by levels of team uncertainty, I propose partial mediation to acknowledge the complexity of coworker relations within team in virtual environments.

Hypothesis 2a: Those working in a virtual environment will report higher team uncertainty compared to those working in a co-located environment.

Hypothesis 2b: Team uncertainty will partially mediate the relationship between work environment and perceived quality of coworker relations.

Social presence. Social presence refers to the degree to which an individual is aware of the presence of other people during a communication exchange. Social presence theory (Short, Williams, & Christie, 1976), commonly used as the foundation for theories on communication medium effects, states that social presence is diminished for those who do not communicate face-to-face. Communication methods that increase the conveyance of social presence lead to satisfaction and low levels of ambiguity among team members. Social context cues that are available in face-to-face conversations such as facial expressions, body language, gestures, and intonation, are inherently reduced in virtual communication (Sproull & Kiesler, 1986), thereby reducing perceptions of the social presence of others. Although virtual communication technologies such as video conferencing enhance the perceived social and psychological presence of communication partners over communication such as email, the social interaction in a virtual environment lacks the immediate involvement and immersive experiences that enrich interactions with coworkers who are co-located (Sarbaugh-Thompson & Feldman, 2000).

It is hypothesized that perceived social presence will partially mediate the relationship between work environment and quality of coworker relations. In line with social presence theory, past research has demonstrated that communicating virtually leads to reduced perceptions of social presence, which in turn leads to greater ambiguity, lower satisfaction, and reduced quality of coworker relations (Sproull & Kiesler, 1986). Therefore, one reason why working virtually will result in lower perceived quality of coworker relations is because of reduced social presence in virtual communication. For those working in a co-located environment, however, the social presence resulting from interacting face-to-face will be positively related with quality of coworker relations.

Partial mediation is proposed instead of full mediation because, according to channel expansion theory (Carlson & Zmud, 1999), impoverished media can be perceived as more capable of transmitting certain social cues depending on the user's experience with that medium. Therefore, I acknowledge that social presence may not account for all the variance in the relationship between work environment and quality of coworker relations.

Hypothesis 3a: Those working in a virtual environment will report lower social presence compared to those working in a co-located environment.

Hypothesis 3b: Social presence will partially mediate the relationship between work environment and perceived quality of coworker relations.

Effects on engagement. The purpose of the JD-R model is to explain how job resources and demands determine employees' levels of engagement. Therefore, when examining the effects of physical presence on perceptions of job demands/resources, it is important to understand how employee engagement is subsequently affected. In line with prior hypotheses on coworker relations, it is predicted that quality of coworker relations can be a demand or a resource. A work environment that increases social interaction and reduces team uncertainty (i.e., a co-located environment) will provide employees with the higher quality coworker relations that are required to buffer task demands, thereby increasing engagement on a task. In contrast, it is proposed that a work environment that decreases social interaction (i.e., a virtual environment) will create a demand on employees because of the reduction in perceived quality of coworker relations, resulting in decreased engagement.

Hypothesis 4: Task engagement will be higher for those in a co-located environment compared to those working in a virtual environment.

Outcomes of Engagement

One of the core components of the JD-R model is that work engagement serves as a mediator between job resources and outcomes (Bakker & Demerouti, 2008; Hakanen & Roodt, 2010). The premise of this mediation model is that job resources play a motivational role and lead to the experience of increased engagement, which in turn leads to positive organizational outcomes such as job performance, organizational commitment, and reduced turnover intentions (Hakanen, Bakker, & Schaufeli, 2006; Hakanen, Schaufeli, & Ahola, 2008; Saks, 2006). Alternatively, an increase in job demands leads to reduced engagement, resulting in negative organizational outcomes such as high levels of stress and turnover (e.g., Schaufeli & Bakker, 2004). This prior research has demonstrated that job resources and demands are linked to specific organizational outcomes through employee engagement (i.e., a model of mediation).

The current study will extend this mediation framework by examining what effect the work environment has on outcomes of employee engagement. Specifically, I will examine whether work environment is a distal variable that affects outcomes of engagement, including effort, task performance, and task satisfaction, through its effects on engagement. These three outcome variables were chosen for this study because the focus of the study is on task engagement, and each variable is an immediate proposed outcome of an employee's level of task engagement.

Task performance. In their recent review of engagement and job performance, Demerouti and Cropanzano (2010) reviewed several models and theories that have linked the two constructs. The JD-R model has received the most empirical support in highlighting the link between job resources and job performance. For example, in a diary

study with flight attendants, Xanthopoulou et al. (2008) found that daily fluctuations in colleague social support indirectly predicted day-levels of job performance through engagement (see also Salanova, Agut, & Peiro, 2005; Salanova & Schaufeli, 2008).

In another recent study, Rich et al. (2010) examined job engagement and performance among firefighters. The authors predicted that because engaged employees invest their physical, cognitive, and emotional energies into their work roles, this engagement would enhance performance because the employees work with greater intensity and are emotionally connected to their tasks. They found that engagement fully mediated the relationship between job resources and task performance. Furthermore, the relationship between performance and engagement was stronger than the relationship between performance and any other variable examined, including job involvement and job satisfaction. These results demonstrate a competitive advantage for employers who are able to foster engagement among their employees.

Though these studies demonstrate a relationship between engagement and performance, the researchers relied on co-located workers (e.g., flight attendants, firefighters) for their samples. Therefore, it is unclear how engagement affects the performance for those working in a virtual environment. I propose that a virtual working environment negatively affects task engagement, which in turn negatively affects performance. Specifically, based on my extended JD-R model, when conditions in the work environment that enable engagement are diminished (e.g., coworker relations), it is questionable whether engagement will sustain performance. If coworker relations are perceived to be a demand in a virtual environment, this may result in reduced engagement and task performance compared to those in a co-located work environment

where coworker relations strengthen engagement, thus resulting in greater task performance.

Consistent with the JD-R model and in keeping with prior studies of engagement and performance, I hypothesize that engagement will fully mediate the relationship between job resources and task performance. Rich et al. (2010) argued that job resources “promote the simultaneous investment of cognitive, emotional, and physical energy into a work role, and this investment, in turn, translates into superior work role performance” (p. 622). In other words, the relationship between quality of coworker relations and task performance is indirect, and it is only through engagement that coworker relations affect task performance (i.e., full mediation). If quality of coworker relations are weakened (because the work environment was virtual, for example), it is proposed that this leads to reduced engagement, which in turn leads to lower task performance. It should be noted that because this study is focused on task engagement, only in-role performance that involves activities related to the core performance of the task will be examined (Borman & Motowidlo, 1993; Motowidlo & Van Scotter, 1994).

Hypothesis 5a: Task performance will be greater for those working in a co-located environment compared to those working in a virtual environment.

Hypothesis 5b: Task engagement will fully mediate the relationship between perceived quality of coworker relations and task performance.

Effort. Effort refers to an exertion of physical or mental power and consists of three components: duration (or time commitment), intensity (or force), and direction (Brown, 1996; Kanfer, 1990). Past empirical studies have demonstrated a positive relationship between effort and performance (e.g., Blau, 1993) and between effort and job

involvement (Brown, 1996). Job involvement, which refers to the degree to which employees identify psychologically with their work (Kanungo, 1982; Lodahl & Kejner, 1965), is viewed as a facet of employee engagement (Salanova et al., 2005). As more individuals identify psychologically with their work, they are more likely to exert greater effort to work activities (Brown, 1996; Kahn, 1990). However, this research has focused on co-located work settings, and as organizations increase their reliance on virtual workers, it is important to understand whether the work environment affects the relationship between employee engagement and effort.

In line with the hypothesis for observed task performance, it is hypothesized that job resources (i.e., coworker relations) indirectly affects self-reported effort and that engagement will fully mediate the relationship between quality of coworker relations and effort. As job resources such as the quality of coworker relations improve (e.g., in a co-located environment), individuals are more likely to invest themselves fully into the work and become engaged on a task. In turn, this engagement leads to effort with greater duration and intensity. When quality of coworker relations is reduced (as it is hypothesized to do in a virtual environment), it is believed that this leads to reduced engagement, and, as a result, lower effort exerted on a task. If an individual is disengaged, however, it is believed that positive coworker relations alone will not sustain increased effort on a task (i.e., no direct effect of quality of coworker relations on effort). Therefore, it is only through engagement that perceived quality of coworker relations affects reported effort during a task.

Hypothesis 6a: Effort will be greater for those working in a co-located environment compared to those working in a virtual environment.

Hypothesis 6b: Task engagement will fully mediate the relationship between perceived quality of coworker relations and effort.

Task satisfaction. Satisfaction refers to a positive, emotional state resulting from one's appraisal of experiences when working on the job (Locke, 1976). Even though satisfaction at work has been linked to a number of variables including individual job performance (see Judge, Toresen, Bono, & Patton, 2001) as well as to organizational and market performance (Schneider, Hanges, Smith, & Salvaggio, 2003), it appears that working in a virtual work environment negatively affects feelings of satisfaction. For example, in a study with virtual work environments, Simon (2006) recently found that although there was no difference in task performance between dyads communicating face-to-face, through instant messaging, and through videoconferencing, task *satisfaction* was lower for those who communicated through instant messages as compared to those who communicated face-to-face or through videoconferencing. Some researchers suggest that the lack of face-to-face interactions in a virtual environment creates limited interpersonal relationships between team members (Warkentin, Sayeed, & Hightower, 1997), which reduces satisfaction. Others have proposed that the lower satisfaction results from lower physiological arousal that occurs in a virtual environment as compared to a face-to-face environment (Bates & Cleese, 2001; Thompson & Coovert, 2001). Both explanations suggest that virtual environments reduce the connection between coworkers, either interpersonally or energetically, resulting in reduced satisfaction.

In a recent study of antecedents and consequences of engagement, Saks (2006) found that employee engagement fully mediated the relationship between job resources and satisfaction. When employees have job resources available, such as high-quality

coworker relations, they are more likely to invest themselves physically, emotionally, and cognitively into their work roles and become more engaged during a task. The experience of engagement is a positive work-related experience and state of mind that, Saks found, resulted in a positive evaluation of one's job. However, Saks' study was focused on employees in a co-located work setting. Consistent with Saks' research, it is expected that the effect of coworker relations on task satisfaction is indirect and that engagement will fully mediate the relationship between quality of coworker relations and task satisfaction. In other words, it is only through engagement that quality of coworker relations affects satisfaction during a task. When the quality of coworker relations is diminished (as in a virtual environment), it is proposed that this will lead to reduced engagement and, in turn, lower task satisfaction. However, when individuals work in an environment with high-quality coworker interactions, it is proposed that these individuals are more likely to become engaged during the task, and this engagement will lead to greater reported satisfaction.

Hypothesis 7a: Task satisfaction will be greater for those working in a co-located environment compared to those working in a virtual environment.

Hypothesis 7b: Task engagement will fully mediate the relationship between perceived quality of coworker relations and task satisfaction.

Summary

In summary, engagement is a psychological state wherein employees employ themselves physically, cognitively, and emotionally into their work performance. Theory and empirical work on engagement suggest that psychological presence and work resources buffer work demands, and they are necessary for employees to become

engaged. However, given the increased use of virtual communication in organizations, researchers and practitioners know little about the effects of a virtual work environment on engagement. To close this gap, I propose an expansion to the JD-R model, a widely-used and established theoretical framework for understanding and explaining employee engagement, whereby consideration is given to contextual variables (e.g., work environment) that can influence an employee's appraisal of a variable as either a job resource or demand. I focus specifically on whether physical presence matters in fostering employee engagement.

The current study has potential theoretical implications to the virtual work and engagement literatures by considering contextual variables that may affect how people perceive whether their work environment enables or hinders the development of their engagement. This proposed revision of the JD-R model may also have practical implications for organizations that employ virtual workers by examining how the work environment affects positive organizational outcomes through engagement. The current study tests the JD-R model with these expansions, thereby making a significant contribution to the empirical literature as well.

METHOD

Participants

A total of 242 participants (163 females and 79 males) were recruited from undergraduate psychology courses at Colorado State University to participate in exchange for course credit. Approximately 83.1% identified themselves as Caucasian/White, 6.2% Latino/Hispanic, 6.2% African American/Black, 3.3% Asian, 0.4% Native American, 2.5% Other/Multi-Racial, and 1.2% declined to identify their ethnicity. When asked about work experience, 8.3% of the sample did not have any work experience, 71.1% had less than five years, 19.8% had between five and ten years, and 0.8% had between 11 and 15 years.

Measures

The full scales for each measure are reproduced in Appendix A. Internal consistency reliability for all scales is estimated with Cronbach's α .

Task engagement. Task engagement was measured using Rich et al.'s (2010) 18-item scale for employee engagement. This engagement scale was chosen over other scales of employee engagement (e.g., the UWES; Schaufeli & Bakker, 2003) because the Rich et al. scale reflect all three dimensions from Kahn's (1990) definition of engagement, including physical, cognitive, and affective engagement, and this was the definition of engagement used in the current study. Participants were asked to report their engagement while working on the study task, and responses were captured on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Items were

reworded slightly to study engagement at the task level as has been done in other studies that examined task engagement including Sonnentag (2003) and Xanthopoulou et al. (2009). Example items include “I feel energetic about the task” and “I focused a great deal of attention to the task.” Higher scores on the scale indicate higher levels of task engagement.

Four items were dropped from the scale due to conceptual overlap with outcome measures. Item 1 (“I worked with intensity on the task”) and item 2 (“I exerted my full effort on the task”) were dropped from the scale due to overlap with the items measuring effort, and item 10 (“I am proud of my work on the task”) and item 11 (“I feel positive about my work on the task”) were dropped from the scale due to overlap with the items measuring task satisfaction. The coefficient α reliability for this final 14-item measure was .97 for task 1 and .98 for task 2.

Rich et al. (2010) conducted a confirmatory factor analysis (CFA) on their full measure and found that a one-factor solution fit the data poorly. A CFA conducted on the current data also revealed a similarly poor fit for a one-factor model of engagement at both time 1, $\chi^2(77) = 1261.35, p < .001, CFI = .71, RMSEA = .25$, and at time 2, $\chi^2(77) = 1247.03, p < .001, CFI = .77, RMSEA = .27$. However, in keeping with Kahn’s (1990) theory of engagement, Rich et al. found support for a model in which three first-order engagement dimensions (i.e., behavioral, cognitive, and affective engagement) loaded onto a second-order engagement dimension. In the current study, a CFA for a three-factor model indicated adequate fit for the current study at both time 1, $\chi^2(74) = 453.98, p < .001, CFI = .91, RMSEA = .15$, and at time 2, $\chi^2(74) = 348.47, p < .001, CFI = .95, RMSEA = .13$. In line with the findings presented by Rich et al., the loadings for the

physical, cognitive, and affective dimensions onto a second-order engagement factor were all positive and statistically significant ($p < .01$) at both time 1 (.95, .84., and .82, respectively) and time 2 (.97, .91., and .88, respectively). Thus, in keeping with Rich et al. and Kahn's theoretical model, a higher-level factor of engagement was used instead of the three sub-factors of engagement.

Team uncertainty. Due to the lack of an existing measure, perceptions of team uncertainty were assessed using an 8-item scale created for the current study ($\alpha = .82$). Items were based on uncertainty management theory (Tangirala & Alge, 2006; Van den Bos & Lind, 2002) and on other team uncertainty research (e.g., Cramton, 2001; Langan-Fox, 2002). Responses were captured on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Example items include "I knew how other team members felt about me" and "I could easily interpret information from other team members." High scores on the scale indicate low levels of perceived uncertainty about other team members. Results of an EFA with maximum likelihood extraction on this new scale indicated a single factor accounting for 53.45% of variance.

Social presence. Perceived social presence was measured using Gunawardena and Zittle's (1997) 9-item scale ($\alpha = .82$). Participants responded to items using a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample items include "Communication was impersonal" and "I felt comfortable interacting with other participants in this study." This scale has been previously used in other studies of social presence (e.g., Russo & Campbell, 2004; Shin, 2003). Higher scores on the scale indicate higher levels of perceived social presence. Because there was no validity evidence from previous research on the factor structure of the scale, an EFA with maximum likelihood

extraction and oblique rotation was conducted. Results of the EFA indicated a two-factor solution with the first factor accounting for 43.60% of the variance, and the second factor accounting for 19.6% of the variance. Since the second factor included only the two reverse-coded items and because the entire scale demonstrated high internal consistency reliability, the decision was made to retain all nine items for the scale.

Coworker relations. Perceived quality of coworker relations was assessed using a combination of four items from May et al.'s (2004) scale of rewarding coworker relations, five items from Moorman's (1991) interactional justice scale, and two items created for this study that assessed interest in working with the same team in the future. Items were slightly reworded to fit the nature of the task, and responses were captured on a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample items include "My team members value my input" and "My team members treated me with respect." Higher scores on the scale indicate a higher quality of coworker relations. An EFA with maximum likelihood extraction was conducted on this new scale, and the result supported a single-factor solution accounting for 56.45% of the variance. Coefficient α reliability for this 11-item measure was .92.

Task performance. Objective ratings of individual task performance were made by trained research assistant (RA) observers who rated participants' performance during the task on five competencies: 1) leading and initiating, 2) creating and conceptualizing, 3) supporting and cooperating, 4) interacting and presenting, and 5) organizing and executing. These competencies were taken from existing measures of effective performance in leaderless group discussions (Bartram, 2005; Costigan & Donahue, 2009). Appendix B lists each competency and its corresponding definition. Two RAs

rated each team member's performance during the task using behaviorally-anchored rating scales for each competency that were created for this study (see Appendix C). The scale ranged from 1 (*needs improvement*) to 5 (*exceptional*). Intraclass correlation coefficients (ICCs) were computed to determine agreement on both task 1 (ICC = .77) and task 2 (ICC = .83) performance. Because these ICCs indicate that the RAs made similar ratings on the competencies, ratings were combined to form one score on each of the competencies. Next, an EFA with maximum likelihood extraction on the five competencies revealed a clear one-factor solution for task 1 performance (factor accounts for 61.01% of variance) and task 2 performance (factor accounts for 83.52% of variance). Internal consistency reliability estimates for the scale was $\alpha = .84$ for task 1 and $\alpha = .86$ for task 2.

Effort. Effort was assessed retrospectively by asking participants to respond to three items on how much time they worked, how intensely they worked, and the overall effort they put forth during the task ($\alpha = .90$). This method of retrospective introspection assessing personal effort has been used by other researchers including Brown, Cron, and Slocum (1997) and VandeWall, Cron, and Slocum (2001). Responses were captured on a Likert-type scale ranging from 1 (*much less than average*) to 5 (*much more than average*). A sample item is, "Compared to other team members, how much time did you spend working on the task?" Higher scores on the scale indicate higher levels of effort. An EFA with maximum likelihood extraction revealed a single-factor solution accounting for 83.52% of the variance.

Task satisfaction. Satisfaction on the task was measured using six items created for this study ($\alpha = .91$). Although items for the scale are conceptually similar to those

found on other satisfaction scales (e.g., Spector, 1985), items were created for this study to specifically measure the participant satisfaction in working on the task and whether he or she was satisfied with his or her performance. Responses were captured on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Sample items include “I am proud of the work my team did on the task” and “I enjoyed working on the task.” High scores on the scale indicate high levels of task satisfaction. An EFA with maximum likelihood extraction on this new scale revealed a single-factor solution accounting for 71.02% of the variance.

Demographics. Each participant was asked to identify his or her age, gender, and ethnicity.

Manipulation check. One item, “I worked with other participants on the task (choose one): face-to-face or virtually” was used to ensure that participants correctly identified the environment they worked in during the task.

Procedure

A two-session laboratory study was conducted to test the study hypotheses. Participants were randomly assigned to work on a marketing task in either a co-located or virtual environment. In creating the task for the current study, the principal goal was to maximize experimental realism so that participants would be psychologically involved (Aronson, Wilson, & Brewer, 1998), which would allow for engagement during the task. Because the sample consisted of college students, the Travel University task developed by Hurd and Byrne (2009) was used. The task was designed for use with college students and previous uses of this task have demonstrated that participants believe the premise of the study and get involved in the task.

A total of five to eight participants were in each work group, and there were 39 groups in total. Prior to the start of the study, each work group was randomly assigned a work environment condition. In the co-located environment, participants were seated at an open conference table in a single room and assigned their own laptop computer to use for the session. In this condition, participants were able to see one another. In the virtual environment, participants were seated in a single room but at individual tables with large partitions placed around them so that they were unable to see any other participant for the duration of the study (simulating a cubicle work environment). They were also each assigned a laptop computer for use during the session. Participants were told that all study data and survey responses would be kept confidential, and all participants created a unique identification number that was used to link performance and survey data from the two sessions.

Research assistants introduced the study as a collaboration between university researchers and a new internet travel agency called Travel University. Participants were shown a seven-minute video on their laptop computers that introduced them to Travel University and the task upon which they would be working. In the video, two company representatives (study confederates) introduced Travel University as a startup online travel agency that offers college students exclusive and discounted travel services. Because the service was targeted for college students, participants were told they were part of a focus group tasked to brainstorm innovative marketing and promotional ideas for Travel University that were customized for their school. Participants were told they would be rated on both their individual performance and their performance in a team of five to eight members, and their performance would be monitored by research assistants.

They were also told that while Travel University was interested in their marketing ideas, the university researchers were interested in examining their group interactions and decision-making. Finally, participants were told that based on the quality of the ideas they generated and their performance in the group, they would be placed into one of two groups and that the higher group of performers would be entered into a lottery for a prize from Travel University.

At the conclusion of the video, participants were given a fact sheet on Travel University (see Appendix D) and an idea sheet that they could use to keep track of their marketing ideas. Participants were then given 10 minutes to individually brainstorm and develop marketing and promotional strategies for Travel University at their school. After this time elapsed, participants were then told to work in their groups for 30 minutes to share and discuss individual ideas, determine the best two ideas, and then develop these ideas in detail. In the co-located condition, participants were able to communicate with each other face-to-face. In the virtual environment, participants communicated with the other members of their group in a virtual chat environment (i.e., a chat room) set-up for this study. The chat room assigned the participants a unique identifier (e.g., Participant A, Participant B, etc.) so that they were able to refer to specific members of their group. In a virtual chat environment, individuals are able to type messages to each other at the bottom of the computer screen while also being able to view the exchange of messages with others shown in the top portion of the screen. The system allowed for multiple messages from the various participants to be written, sent, and viewed at the same time. Delays in communication occurred because of the time needed to type a message.

During the group interaction, research assistants took behavioral observation notes that they later used to rate each participant on the task competencies. In the virtual environment, the research assistants logged into the virtual chat environment with the participants and were able to view the entire team interaction (though they did not participate in the exchanges). At the end of the group portion of the task, the RAs then collected the participant idea sheets in both the virtual and co-located conditions.

Immediately after submitting their idea sheets, participants then completed on their laptop computers an electronic questionnaire that measured team uncertainty, social presence, quality of coworker relations, task engagement, demographics, and the manipulation check item. Participants were told that the company representatives would review the ideas and then select the best idea for the group to work on in greater detail during the second session. The first session lasted approximately 1.5 hours.

The second session occurred exactly one week after the first session. A second session was conducted in order to give participants the opportunity for feedback on their performance during the first session and to examine the relationship between engagement and performance at a second time. Between the two sessions, an electronic feedback report was created for each participant to summarize their performance during the first task. These individual feedback reports included the ratings on each competency and reflected actual performance during the first task as rated by the RAs. At the beginning of the second session, the same participants were assigned to the same work environment as the first session (i.e., either co-located or virtual) and assigned a laptop computer. After being seated, participants were given their individualized feedback reports and given 15 minutes to review the information.

Participants were then shown a four-minute video on their laptop that introduced the task they would be working on for the second session. In the video, the company representatives (the same study confederates) informed the participants that one of the group's ideas from the first session had been selected to be further developed into a detailed plan which Travel University could then potentially use to implement the concept at their school. The plan generated by the group needed to include the full scope of marketing activities that Travel University could use to attract potential customers and generate revenue, including advertising plans, slogans, viral marketing campaigns, and potential events. The company representatives then stated that they would review all of the plans submitted by the different focus groups and select one team to be the winner of the competition.

Participants were given an idea sheet and 10 minutes to individually brainstorm and develop a marketing plan. After working alone, participants were then told to work in their groups for 30 minutes to share their ideas, pick the best ones, and as a group develop a comprehensive plan to market the best ideas. Participants were again told they would be rated on both their individual and team performance and that their performance would be monitored by research assistants. During the group interaction, the research assistants rated performance on the five competencies in both the face-to-face and virtual work environments. At the end of the session, the RAs gathered the idea sheets. Participants then completed on their laptop a final questionnaire that measured task engagement, effort, task satisfaction, and the manipulation check item. Participants were then debriefed as a group and told the true nature of the study. The second session lasted approximately one hour.

RESULTS

Preliminary Analyses

Before testing the study hypotheses, several preliminary analyses were conducted to explore 1) possible group-level differences in study variables, 2) the effects of team size, 3) the relationship between the same variables across sessions, and 4) the strength of the work environment manipulation.

Group-level differences. In the current study, all perceptions and outcome ratings were measured at the individual level. Therefore, the data were analyzed at an individual rather than at a group level. In designing the study, efforts were made to ensure that all groups had a similar experience, and past research has shown that individuals in a group rate team dynamic variables differently (e.g., team uncertainty, see van Prooijen, Van den Bos, & Wilke, 2005). To explore possible non-interdependence and the extent to which responses from individuals in the same team were influenced by the group itself, an intraclass coefficient (ICC) was estimated for each study variable (i.e., social presence, team uncertainty, coworker relations, task 1 and task 2 engagement, task 1 and task 2 performance, effort, and task satisfaction) following procedures recommended by Bliese (2000) to estimate the presence of group-level effects. The ICCs for all nine variables were not significant, and for all but two variables (i.e., quality of coworker relations and task 1 engagement) the within group variance was greater than between group variance. These results suggest that individual responses were not dependent on group membership.

Effects of team size. Since team size varied across teams in the current study, the effect of team size on the measured variables was examined. Participants in the current study worked in groups of five ($N = 61$), six ($N = 78$), seven ($N = 63$), and eight ($N = 40$). To examine differences in the study variables as a function of group size, a one-way MANOVA was conducted with the nine variables as the dependent variables and group size as the independent variable. A MANOVA was conducted instead of nine separate ANOVAs to control for experimentwise error. There was no statistically significant difference on the linear combination of dependent variables as a function of group size, $F(27, 590) = 0.96, p = .518, \text{Wilk's Lambda} = .88$. Therefore, group size did not affect the study variables, and data across groups of different sizes were combined to test the study hypotheses.

Relationship between variables across sessions. Since engagement and task performance were measured during both session 1 and session 2, the relationship between the variable at time 1 and the same variable at time 2 was examined. Results indicate that participant engagement during task 1 ($M = 5.00, SD = 1.05$) and task 2 ($M = 4.88, SD = 1.31$) was significantly related, $r = .62, p < .001$. Additionally, participant performance during task 1 ($M = 3.16, SD = 0.64$) and task 2 ($M = 3.19, SD = 0.69$) was also significantly related, $r = .58, p < .001$. These results reveal similar behavior and attitudes in participants as a function of study session.

Manipulation check. Finally, a manipulation check was performed to ensure that the participants accurately perceived their work environment as either virtual or co-located. All participants correctly identified their work setting as either “face-to-face” (N

= 116) or “virtual” ($N = 126$). This suggests that the environment manipulation used in the study was successful.

Descriptive statistics. Means, standard deviations, intercorrelations, and reliability estimates for all of the variables in the study are shown in Table 1. All scales demonstrate adequate reliability (Nunnally & Bernstein, 1994), ranging from .82 to .98. Table 2 shows the means and standard deviations as a function of work environment for each variable.

Hypothesis 1

Hypothesis 1 proposed that quality of coworker relations would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples t -test revealed a significant difference in quality of coworker relations between work environments, $t(238) = 8.01, p < .001, d = 1.04$. Quality of coworker relations varied as a function of work environment. Participants working in a co-located environment ($M = 4.12, SD = 0.56$) reported significantly higher quality of coworker relations than those working in a virtual environment ($M = 3.47, SD = 0.68$), thus providing support for Hypothesis 1.

Mediation Models

Hierarchical multiple linear regression analyses were conducted to test for mediation (Hypotheses 2-3, 5-7) following the four-step procedure outlined by Baron and Kenny (1986). In the first step of each mediation model, the outcome variable was regressed on the predictor variable. In the second step, the mediator variable was regressed on the predictor variable. In the third step, the outcome variable was regressed on the mediator variable. In the final step, the outcome variable was regressed on the

predictor variable after controlling for the mediator variable. Partial mediation occurs if the relationship between the predictor and outcome is significantly reduced after controlling for the mediator variable, and full mediation is detected if the relationship between the predictor and outcome variable is non-significant after controlling for the mediator variable. When either partial or full mediation is detected, a Sobel test will be performed to determine the significance of the mediation effect.

Hypothesis 2

Hypothesis 2a proposed that team uncertainty would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test revealed a significant difference in team uncertainty between work environments, $t(238) = 7.07, p < .001, d = 0.92$. Participants working in a co-located environment ($M = 3.99, SD = 0.57$) reported significantly higher team certainty than those working in a virtual environment ($M = 3.43, SD = 0.66$), thus providing support for Hypothesis 2a.

Hypothesis 2b proposed that team uncertainty partially mediates the relationship between work environment and perceived quality of coworker relations. As shown in Table 3, work environment is a predictor of both coworker relations ($\beta = .46, t = 8.01, p < .001$) and team uncertainty ($\beta = .42, t = 7.07, p < .001$), and team uncertainty is a predictor of coworker relations ($\beta = .66, t = 13.49, p < .001$). After controlling for team uncertainty, the magnitude of the relationship between work environment and quality of coworker relations drops but is still significant ($\beta = .23, t = 4.37, p < .001$). A Sobel test revealed that the mediation effect detected was significant, $z = 6.10, p < .001$. These results show support for Hypothesis 2b and indicate that the indirect effect of work

environment on quality of coworker relations can be explained, in part, by the effects of work environment on team uncertainty. Team uncertainty is higher in a virtual environment than it is in a co-located environment, and this leads to reduced quality of coworker relations.

Hypothesis 3

Hypothesis 3a proposed that social presence would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test revealed a significant difference in social presence between work environments, $t(238) = 9.13, p < .001, d = 1.19$. Participants working in a co-located environment ($M = 3.96, SD = 0.57$) reported significantly higher social presence than those working in a virtual environment ($M = 3.26, SD = 0.61$), thus providing support for Hypothesis 3a.

Hypothesis 3b proposed that social presence partially mediates the relationship between work environment and perceived quality of coworker relations. As shown in Table 4, work environment is a predictor of both coworker relations ($\beta = .46, t = 8.01, p < .001$) and social presence ($\beta = .51, t = 9.13, p < .001$), and social presence is a predictor of coworker relations ($\beta = .77, t = 18.88, p < .001$). After controlling for social presence, the magnitude of the relationship between work environment and quality of coworker relations drops but is still significant ($\beta = .09, t = 2.03, p = .043$). A Sobel test revealed that the mediation effect detected was significant, $z = 8.19, p < .001$. These results show support for Hypothesis 3b and indicate that the indirect effect of work environment on quality of coworker relations can be explained, in part, by the effects of work

environment on social presence. Social presence is lower in a virtual environment than it is in a co-located environment, and this leads to reduced quality of coworker relations.

Hypothesis 4

Hypothesis 4 proposed that task engagement would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test was calculated to compare reported task engagement during task 1 and task 2. For task 1, results indicate a significant difference in task engagement between work environments, $t(238) = 3.75, p < .001, d = 0.49$. Participants working in a co-located environment ($M = 5.26, SD = 0.92$) reported significantly greater task engagement than those working in a virtual environment ($M = 4.76, SD = 1.11$). During task 2, results also indicate a significant difference in task engagement between work environments, $t(215) = 2.59, p = .010, d = 0.35$. Participants working in a co-located environment ($M = 5.11, SD = 1.23$) reported significantly greater task engagement than those working in a virtual environment ($M = 4.66, SD = 1.34$). These results provide support for Hypothesis 4b and indicate that task engagement is higher in a co-located work environment than it is in a virtual work environment.

Hypothesis 5

Hypothesis 5a proposed that task performance would be greater for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test was calculated to compare performance ratings during task 1 and task 2. For task 1, results indicate a significant difference in task performance between work environments, $t(240) = 2.75, p = .006, d = 0.35$. Participants working in a co-located environment ($M = 3.28, SD = 0.66$) performed significantly better overall than

those working in a virtual environment ($M = 3.05$, $SD = 0.61$). During task 2, however, there was no significant difference in performance between the work environments, $t(214) = 1.31$, $p = .193$. Performance for participants working in a co-located environment ($M = 3.25$, $SD = 0.72$) was not significantly different from the performance of those working in a virtual environment ($M = 3.13$, $SD = 0.65$). These results provide partial support for Hypothesis 5a.

Hypothesis 5b proposed that task engagement would fully mediate the relationship between perceived quality of coworker relations and task performance. As shown in Table 5, coworker relations is a predictor of both task 1 performance ($\beta = .22$, $t = 3.41$, $p = .001$) and task 1 engagement ($\beta = .40$, $t = 6.63$, $p < .001$), and task 1 engagement is a predictor of task 1 performance ($\beta = .30$, $t = 4.80$, $p < .001$). After controlling for task 1 engagement, the magnitude of the relationship between quality of coworker relations and task 1 performance is no longer significant ($\beta = .12$, $t = 1.74$, $p = .084$). A Sobel test revealed that the mediation effect detected was significant, $z = 3.26$, $p = .001$.

As shown in Table 6, coworker relations is a predictor of both task 2 performance ($\beta = .18$, $t = 2.12$, $p = .035$) and task 2 engagement ($\beta = .19$, $t = 2.88$, $p = .004$), and task 2 engagement is a predictor of task 2 performance ($\beta = .51$, $t = 8.60$, $p < .001$). After controlling for task 2 engagement, the magnitude of the relationship between perceived quality of coworker relations and task 2 performance is no longer significant ($\beta = .08$, $t = 1.36$, $p = .175$). A Sobel test revealed that the mediation effect detected was significant, $z = 2.71$, $p = .007$. Together, the results from task 1 and task 2 indicate support for Hypothesis 5b. The indirect effect of quality of coworker relations on task performance

can be fully explained by task engagement. During both task 1 and task 2, quality of coworker relations was positively related to task engagement, which, in turn, was related to higher performance.

Hypothesis 6

Hypothesis 6a proposed that effort would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test revealed no significant difference in effort between work environments, $t(215) = 1.30, p = .195$. Reported effort for participants working in a co-located environment ($M = 3.38, SD = 0.71$) was not significantly different from those working in a virtual environment ($M = 3.26, SD = 0.78$), thus providing no support for Hypothesis 6a.

Hypothesis 6b proposed that task engagement would fully mediate the relationship between perceived quality of coworker relations and effort (note that effort was only measured at time 2). As shown in Table 7, coworker relations is a predictor of both effort ($\beta = .14, t = 2.12, p = .035$) and task 2 engagement ($\beta = .19, t = 2.88, p = .004$), and task 2 engagement is a predictor of effort ($\beta = .69, t = 13.87, p < .001$). After controlling for task 2 engagement, the magnitude of the relationship between quality of coworker relations and effort is no longer significant ($\beta = .01, t = .22, p = .825$). A Sobel test revealed that the mediation effect detected was significant, $z = 2.81, p = .005$. These results provide support for Hypothesis 6b and indicate that the indirect effect of quality of coworker relations and effort can be fully explained by task engagement. Quality of coworker relations is positively related to task engagement, which, in turn, is related to greater effort.

Hypothesis 7

Hypothesis 7a proposed that task satisfaction would be higher for those working in a co-located environment compared to those working in a virtual environment. An independent samples *t*-test revealed a significant difference in task satisfaction between work environments, $t(215) = 4.29, p < .001, d = 0.59$. Participants working in a co-located environment ($M = 5.36, SD = 1.07$) reported significantly higher task satisfaction than those working in a virtual environment ($M = 4.69, SD = 1.21$), thus providing support for Hypothesis 7a.

Hypothesis 7b proposed that task engagement would fully mediate the relationship between perceived quality of coworker relations and task satisfaction (note that task satisfaction was only measured at time 2). As shown in Table 8, coworker relations is a predictor of both task satisfaction ($\beta = .33, t = 5.05, p < .001$) and task 2 engagement ($\beta = .18, t = 2.63, p = .009$), and task 2 engagement is a predictor of task satisfaction ($\beta = .84, t = 22.68, p < .001$). After controlling for task 2 engagement, the magnitude of the relationship between quality of coworker relations and effort drops but is still significant ($\beta = .18, t = 5.16, p < .001$). A Sobel test revealed that the mediation effect detected was significant, $z = 2.85, p = .004$. Although these results do not provide support for Hypothesis 7b (full mediation), they do indicate that the effect of perceived quality of coworker relations and task satisfaction is indirect. Task engagement partially mediates the relationship between perceived quality of coworker relations and task satisfaction, and task engagement is one variable that explains this indirect effect. Quality of coworker relations is positively related to task engagement, which, in turn, is related to increased task satisfaction.

Summary of Results

In summary, the results of the current study indicate that those working in a co-located environment reported significantly greater coworker relations, social presence, task 1 and task 2 engagement, task 1 performance, and task 2 satisfaction and lower team uncertainty. There was no significant difference between work environments on task 2 performance and effort. Team uncertainty and social presence both partially mediated the relationship between work environment and perceived quality of coworker relations. Figure 2 depicts a visual representation of the relationship between coworker relations and task engagement for both work environments. As seen in this figure, task engagement is higher for those working in a co-located environment as a function of the perceived quality of coworker relations. Finally, task engagement fully mediated the relationship between quality of coworker relations and both task 1 and task 2 performance as well as effort. Although full mediation was not supported for task satisfaction, results indicated that task engagement partially mediated the relationship between perceived quality of coworker relations and task satisfaction.

DISCUSSION

The purpose of the current study was to understand what effect a virtual work environment has on engagement, its antecedents, and outcomes. The results will be discussed in three parts. First, in considering the effects of work environment on antecedents of engagement, quality of coworker relations was rated higher by those working in a co-located environment than by those working in a virtual environment. This means that individuals working face-to-face reported better working relations with their colleagues than those who work virtually with their peers, which in turn led to greater engagement. Quality of coworker relations is one of the most commonly examined antecedents of employee engagement (Halbesleben, 2010), and the results of this study are significant because they identify one distal variable that changes how quality of coworker relations is perceived and affects engagement. To understand this relationship further, I proposed that the effect of work environment on quality of coworker relations was indirect, and I examined whether this relationship could be explained in part by the effect of work environment on team uncertainty and social presence. Results demonstrated support for both partial mediation hypotheses. That is, for those working virtually, perceived team uncertainty was higher and social presence was rated lower as compared to those working in a co-located environment. Taken together, these findings reveal that an individual's work environment changes how information and communication partners are perceived, which in turn affects the quality of coworker relations.

Second, the effects of work environment itself on engagement were examined. Task engagement was significantly higher for those working in a co-located environment compared to those working virtually during both task 1 and task 2. Although past research has considered numerous predictors of engagement including social support, autonomy, feedback, and personal resources such as self-efficacy (Halbesleben, 2010; Saks, 2006), distal predictors of engagement, such as work environment, have not been considered. These results give insight into how perceptions of task engagement are formed. The work environment itself is a distal predictor of engagement through its effects on team uncertainty and social presence. Greater social presence and lower team uncertainty result in greater perceived quality of coworker relations, which in turn leads to greater reported task engagement.

Finally, the effects of work environment on engagement outcomes were examined. Task engagement fully mediated the relationship between coworker relations and task 1 and task 2 performance and reported effort. This indicates that the effect of coworker relations on task performance and effort is indirect and is explained by the effect of coworker relations on task engagement. Higher quality of coworker relations leads to greater task engagement, which in turn results in increased performance and greater exerted effort. Additionally, task engagement partially mediated the relationship between coworker relations and task satisfaction, indicating that the effect of work environment on task satisfaction is indirect and explained in part by task engagement. Higher quality of coworker relations is related to increased task engagement, which results in increased task satisfaction. However, quality of coworker relations may still have a direct effect on task satisfaction or there may be variables other than task

engagement that also explain this indirect relationship. While these findings are in line with past research showing that engagement mediates the relationship between job resources (e.g., quality of coworker relations) and variables such as performance and satisfaction (Hakanen & Roodt, 2010), the current study goes further by examining distal variables such as work environment that affect these outcome variables through task engagement.

In comparing the virtual and co-located work environments on the outcome variables, those working virtually had lower task 1 performance and overall reported task satisfaction compared to those working in a co-located environment. Consistent with the JD-R model of engagement (Bakker & Demerouti, 2007), when conditions in the work environment that enable task engagement are diminished (e.g., coworker relations) the results here demonstrate that reduced task engagement will result in lower performance and task satisfaction. However, there was no difference between those working co-located or virtually on task 2 performance or effort. Because there was no difference between environments on task 2 performance, this may indicate that the effects of a virtual work environment are only temporary, and that over time those working in a virtual environment can have similar levels of task performance as compared to those working in a co-located work environment. For effort, it is important to note that those who work co-located reported a similar level of expended effort as compared to those working virtually even though the co-located individuals reported a higher level of task engagement. This indicates that effort and engagement may have different predictors and is an avenue for future research.

Theoretical and Practical Implications

Based on these findings, there are two important theoretical implications for engagement research that warrant discussion. First, the findings of this study indicate that researchers should continue to place greater attention on contextual variables that affect employee engagement. Existing models of engagement, such as the JD-R model, only consider proximal predictors of engagement including job resources and job demands. However, the current findings reveal that researchers should also include distal variables (e.g., working co-located or working virtually) in their models of engagement as these contextual variables may enable or hinder the development of employee engagement and, as a result, affect outcomes of engagement including performance and task satisfaction. In their examination of state work engagement, Sonnentag et al. (2010) discovered that there is a within-person variation on engagement due to distal day-level processes (e.g., opportunity to recover from previous work; Sonnentag, 2003) and day-level job resources. Based on the findings of the current study, work environment should be considered a distal day-level factor that affects engagement, and it is argued that this contextual variable should be incorporated into the JD-R and other models of engagement. By considering additional factors beyond resources and demands that affect engagement, researchers can expand the nomological network of engagement and increase the understanding of different types of variables that can affect engagement at work. These processes shape work engagement, which in turn affects work outcomes such as job performance and satisfaction.

The second theoretical implication for the current study is in the proposed reconceptualization of job resources and demands as defined by the JD-R model.

Currently, the JD-R model proposes that the availability (or frequency) of resources aids the development of employee engagement, especially in the face of high demands (Bakker et al., 2007). However, in the current JD-R model, variables are simply listed as either a resource or demand, and there is no way for researchers and practitioners to determine whether a new variable should fall into either category or whether the presence of a variable makes it a resource or demand. I argue that individual perception of a variable (e.g., coworker relations) is what defines a variable as a resource or demand, not its frequency or availability. Lazarus and Folkman (1984) propose that individual perception is what determines whether a variable is a stressor (or demand). For example, even though the JD-R model may propose that a variable is a demand, individuals may not perceive the stressor as a threat and may even view it as positive or challenging. Additionally, the current study revealed that employees may not always be engaged in the presence of coworkers. While the availability of coworkers is thought to be a resource according to the current JD-R model, my proposed extension of the model sets boundary conditions for when the presence of coworkers is actually a resource, such that individual perception of work conditions should be the focus of engagement researchers. This theoretical contribution of the current study would change the way researchers and practitioners use the JD-R model. Variables in the JD-R model may not be absolute, and instead the variables should be classified according to individual perception.

By including contextual variables such as work environment in the JD-R model, engagement researchers may be able to better predict whether employees perceive a variable as a resource or demand. In the current study, those who reported lower quality coworker relations reported lower engagement. This suggests that lower quality of

coworker relations may be perceived as a demand, though future research is needed to explicitly test this supposition. On one hand, working virtually lowered the quality of coworker relations in part by increasing team uncertainty and lowering perceived social presence. On the other hand, co-location reduced team uncertainty and enhanced social presence, resulting in increased quality of coworker relations. The level of perceived quality of coworker relations could indicate whether the variable was a resource or demand, and this perception of quality of coworker relations was critical in determining whether an employee became engaged or disengaged. By considering individual perception as a determinant of whether variables are resources or demands, researchers may have a better ability to predict employee engagement in different work settings.

These findings may also have theoretical implications for the virtual teams literature. In their review of the virtual teams literature, Powell, Piccoli, and Ives (2004) gave a call to action for researchers to examine the structural and contextual differences in work environments that affect observed relationships of virtual teams. The results of the current study indicate that the work environment itself is a contextual variable that affects the perception of quality of coworker relations through team uncertainty and social presence as well as engagement during a task. Future research should examine how perceptions of quality of coworker relations in a virtual environment affect other team variables such as group cohesion.

In addition to these theoretical contributions, the current study also has important practical implications for organizations by examining how the work environment affects positive organizational outcomes through engagement. For those organizations that have employees who communicate virtually, the question arises whether physical presence is

also needed to enable employee engagement. The results of this study indicate that physical presence does enable task engagement. Although virtual work does have demonstrated benefits including increased flexibility and lower costs, this study highlights one area where virtual communication may negatively affect work outcomes. This difference in engagement may be due to reduced connection between workers either interpersonally (Warkentin, Sayeed, & Hightower, 1997) or energetically (Bates & Cleese, 2001; Thompson & Coover, 2001).

With the increased understanding of the importance of engagement as it relates to overall financial health of an organization (Bates, 2004; Johnson, 2004; Kowalski, 2003), organizations must enable employees to bring their full capabilities to their work. In a recent report of business executives attitudes toward virtual work, it was noted that face-to-face meetings were preferred because it was believed that engagement among their employees was higher when they were co-located and working together as opposed to when they met virtually (Whitehead, 2010). The current study provides empirical support for this belief that virtual workers are not as engaged as co-located workers, which in itself is a significant finding for those managers and organizations that seek to enhance the engagement of their employees. This reduced engagement also has an effect on task performance and task satisfaction. However, it is important to note that though there was a difference in task performance during the first task, there was no difference in performance across environments during the second task. This finding indicates that the difference in performance may diminish over time as a result of increased familiarity with coworkers and experience with working in a virtual environment. Future research

should examine the relationship between engagement and performance for virtual workers over extended periods.

The results of this study are also important for organizations who are designing tasks for virtual workers. Venkatesh and Johnson (2002) found that when a virtual work environment mimics a co-located workplace, there is a greater employee acceptance and usage of the technology. Therefore engagement interventions (Leiter & Maslach, 2010) for virtual workers should focus on creating an environment of positive coworker relations through periodic face-to-face meetings or team building activities.

Organizations that are able to foster engagement among their employees, even in a virtual environment, will demonstrate a competitive advantage.

Limitations and Strengths

The implications from this study must be interpreted in the context of limitations of the current study. A laboratory study was conducted to provide control over the random assignment of participants to work in either a virtual or co-located work environment. This type of control would have been difficult to obtain using a field sample due to concerns about assigning project teams to work in a virtual environment. Additionally, this controlled environment provided the ability to isolate the context of a virtual environment. In a true telework environment, other extraneous variables in the telework environment (e.g., interruptions, work/life demands) may affect employee task engagement. However, by creating an extreme dichotomy of work environments, a consequential limitation is that this may not mirror actual work environments where employees may interact with their colleagues both face-to-face and virtually. Further, although the experimental design allowed for the ability to infer causal relationships (i.e.,

internal validity), one limitation of the current study is the generalizability of the findings (i.e., external validity) to all organizations that employ virtual workers. While there is concern about using college participants in psychological research (see Sears, 1986), it should be noted that in the current study 91.7% of participants had prior work experience. Furthermore, researchers have found similar effect sizes in laboratory and field investigations across various domains (Anderson, Lindsey, & Bushman, 1999).

In creating the task for the current study, the principal goal was to maximize experimental realism so that participants would be psychologically involved in the task and take it seriously (Aronson et al., 1998). Because the sample consisted of college students, a realistic task was created (i.e., a marketing focus group for a website targeted for college students) so that participants would believe the premise of the study. Additionally, individualized feedback reports were generated for each participant between the two sessions, which mirrors the opportunity for feedback that employees may receive after working on a project team. A follow-up questionnaire completed by all study participants at the end of the study revealed that 87% of the participants found the task believable, and 82% said that the feedback was believable. Such efforts contribute to the psychological and experimental realism of the study, providing some confidence in the potential for generalizing the observed results to field settings.

Another limitation is that all study variables were measured through surveys, which may introduce common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). This common method variance could explain some of the high correlations among variables observed in the current study. To limit the effects of common method variance, it should be noted that the independent variable (work

environment) was assigned to all participants, thereby providing a difference source for the independent and dependent variables, and study variables were measured over two occasions separated by a week.

Finally, in the current study, participants in the virtual condition worked in the same room as the other people in their group, separated by dividers to mimic a cubicle work environment or satellite office. Although participants were not allowed to see or talk to one another, they knew that their other team members were in the same physical room as they were. In actual work settings, employees may be physically separated from their colleagues and use virtual communication similar to the environment created for this study (e.g., email or web chat). This set-up, however, does limit the generalizability of the results to *all* virtual work environments. For example, in a true telework environment, employees work remotely from their homes and do not see their coworkers. Therefore, the current study is generalizable to organizations that employ workers who communicate virtually with one another even though they may be in the same physical location as some of their colleagues (e.g., in another building, in another cubicle, or down the hall).

Future Research Directions

In addition to replicating the current study's findings using a field sample, future research is needed to further understand the effect of a virtual work environment on task engagement, its antecedents, and outcomes. Quality of coworker relations was the antecedent to engagement that was the focus for the current study. Future research should also examine other variables that may be both a resource and demand depending on the work environment including work-family balance, company culture toward virtual

communication, and personal resources that may buffer the demands of a virtual workplace such as self-efficacy and resilience. Additionally, future research should investigate how the work environment affects components of the job itself including skill variety, task identity, task significance, autonomy, and feedback. According to Job Characteristics Theory (Hackman & Oldham, 1980), these task characteristics are linked with critical psychological states and with outcomes such as performance, job satisfaction, low absenteeism, and turnover. With the increase in virtual work environments, the question remains how these new work environments affect perceptions of these job characteristics and, as a result, employee engagement (Shirom, 2010; Shraga & Shirom, 2009).

Future research should also investigate other work related outcomes of engagement including extra-role performance, organizational commitment, health outcomes (e.g., physical health, sleep quality, stress), and turnover in order to understand how a virtual working environment affects additional outcomes of engagement. Other work settings and tasks should also be examined, including a telework environment where employees are in different physical locations from one another. In looking at virtual communication, research should also examine other group-level characteristics such as familiarity with coworkers, experience communicating with coworkers, group cohesion, teamwork, or other variables that may buffer the virtual work environment. Finally, although this study examined the effect of work environment and engagement at two points in time separated by a week, future research should also examine this relationship over a longer period of time to see how these relationships and perceptions of resources and demands may change over time.

Conclusion

Technology has changed the nature of the way people work and the way that people communicate with one another at work. As employees increase their reliance on computer-mediated communication to accomplish their work tasks, organizations must consider what effect adopting virtual work has on employee attitudes and behavior.

Although technology has the enormous potential to connect employees, the results of this study highlight some potential drawbacks of virtual communication. Given the increasing need for the engaged worker, the question arises whether both physical and psychological presence are needed to be engaged. The findings presented here demonstrate that the work environment does matter, and in addition to psychological presence, physical presence is also needed for employees to be engaged at work.

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Table 1

Means, Standard Deviations, Intercorrelations, and Reliability Estimates for Study Variables (N = 242)

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1 Work Environment	1.52	0.50	--									
2 Team Certainty	3.70	0.68	.42**	(.85)								
3 Social Presence	3.59	0.69	.51**	.68**	(.82)							
4 Coworker Relations	3.78	0.71	.46**	.66**	.77**	(.93)						
5 Engagement (Task 1)	5.00	1.05	.24**	.28**	.35**	.40**	(.97)					
6 Engagement (Task 2)	4.88	1.31	.17*	.18**	.17*	.19**	.62**	(.98)				
7 Performance (Task 1)	3.16	0.64	.18*	.14*	.25**	.22**	.30**	.35**	(.84)			
8 Performance (Task 2)	3.19	0.69	.09	.14*	.17*	.18**	.36**	.51**	.58**	(.86)		
9 Effort	3.32	0.74	.09	.14*	.14*	.14*	.45**	.69**	.37**	.51**	(.90)	
10 Task Satisfaction	5.01	1.19	.28*	.28**	.32**	.33**	.51**	.84**	.40**	.50**	.63**	(.91)

Note. Coefficient α reliabilities are shown along the diagonal

^a 1 = Virtual; 2 = Face-to-face

* $p < .05$

** $p < .01$

Table 2

Means and Standard Deviations for Study Variables as a Function of Work Environment

Variable	Work Environment					
	Face-to-face			Virtual		
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>
Team Certainty	114	3.99**	0.57	126	3.43**	0.66
Social Presence	114	3.96**	0.57	126	3.26**	0.61
Coworker Relations	114	4.11**	0.56	126	3.47**	0.68
Engagement (Task 1)	114	5.26**	0.92	126	4.76**	1.11
Engagement (Task 2)	104	5.11*	1.23	113	4.66*	1.34
Performance (Task 1)	116	3.27*	0.66	126	3.05*	0.61
Performance (Task 2)	104	3.24	0.72	112	3.13	0.65
Effort	104	3.39	0.70	113	3.26	0.78
Task Satisfaction	104	5.36**	1.07	113	4.69**	1.21

Note. *Significant difference between means across work environment, $p < .05$

**Significant difference between means across work environment, $p < .01$

Table 3

Mediation of Team Uncertainty on Work Environment and Quality of Coworker

Relations (N = 240)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Work Environment	.65**	.08	.46**	64.21**	.21**	
2	Team Certainty	.68**	.05	.66**	181.87**	.43**	
3	Team Certainty	.59**	.05	.56**	107.39**	.47**	.04**
	Work Environment	.32**	.07	.23**			

Note. Dependent variable is quality of coworker relations.

***p* < .01

Table 4

Mediation of Social Support on Work Environment and Quality of Coworker Relations (N

= 240)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Work Environment	.65**	.08	.46**	64.21**	.21**	
2	Social Presence	.80**	.04	.77**	356.33**	.60**	
3	Social Presence	.75**	.05	.73**	181.91**	.61**	.01
	Work Environment	.13*	.07	.09*			

Note. Dependent variable is quality of coworker relations.

**p* < .05

***p* < .01

Table 5

Mediation of Engagement on Quality of Coworker Relations and Task 1 Performance (N

= 240)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Coworker Relations	.20**	.06	.22**	11.60**	.05**	
2	Task Engagement	.18**	.04	.30**	23.08**	.09**	
3	Task Engagement	.15**	.04	.25**	13.14**	.10**	.01
	Coworker Relations	.10	.06	.12			

Note. Dependent variable is task 1 performance.

***p* < .01

Table 6

Mediation of Engagement on Quality of Coworker Relations and Task 2 Performance (N = 214)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Coworker Relations	.17*	.07	.18*	6.70*	.03*	
2	Task Engagement	.27**	.03	.51**	75.46**	.26**	
3	Task Engagement	.26**	.03	.50**	38.81**	.27**	.01
	Coworker Relations	.08	.06	.08			

Note. Dependent variable is quality of task 2 performance.

**p* < .05

***p* < .01

Table 7

Mediation of Engagement on Quality of Coworker Relations and Effort (N = 215)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Coworker Relations	.15*	.07	.14*	4.51*	.02**	
2	Task Engagement	.39**	.03	.69**	191.10**	.47**	
3	Task Engagement	.39**	.03	.69**	95.15**	.47**	.00
	Coworker Relations	.01	.06	.01			

Note. Dependent variable is effort.

**p* < .05

***p* < .01

Table 8

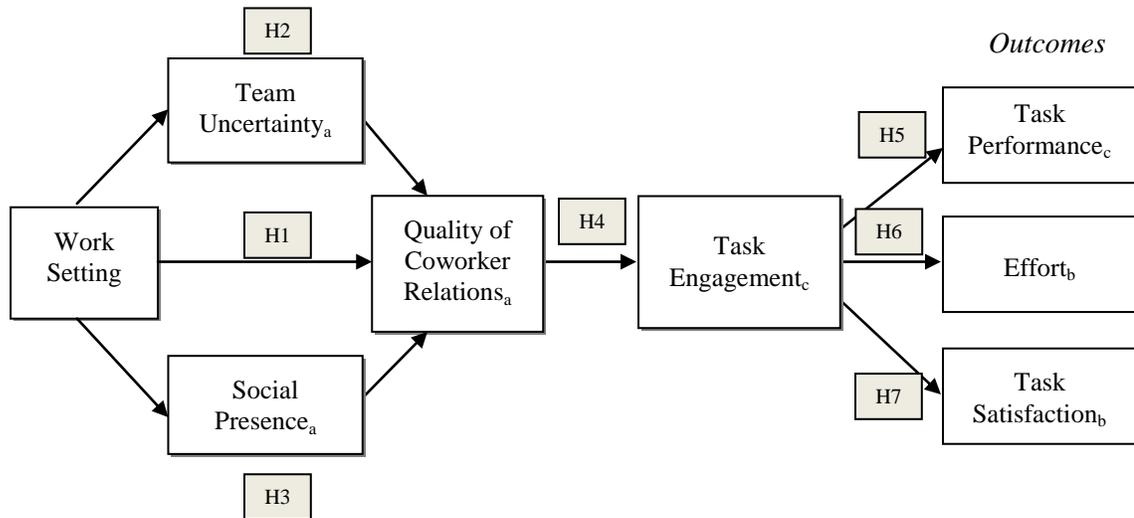
Mediation of Engagement on Quality of Coworker Relations and Task Satisfaction (N = 215)

Equation	Independent	<i>b</i>	<i>se_b</i>	β	<i>F</i>	<i>R</i> ²	ΔR^2
1	Coworker Relations	.57**	.11	.33**	26.13**	.11**	
2	Task Engagement	.77**	.03	.84**	509.40**	.71**	
3	Task Engagement	.74**	.03	.81**	293.19**	.74**	.03**
	Coworker Relations	.30**	.06	.18**			

Note. Dependent variable is task satisfaction.

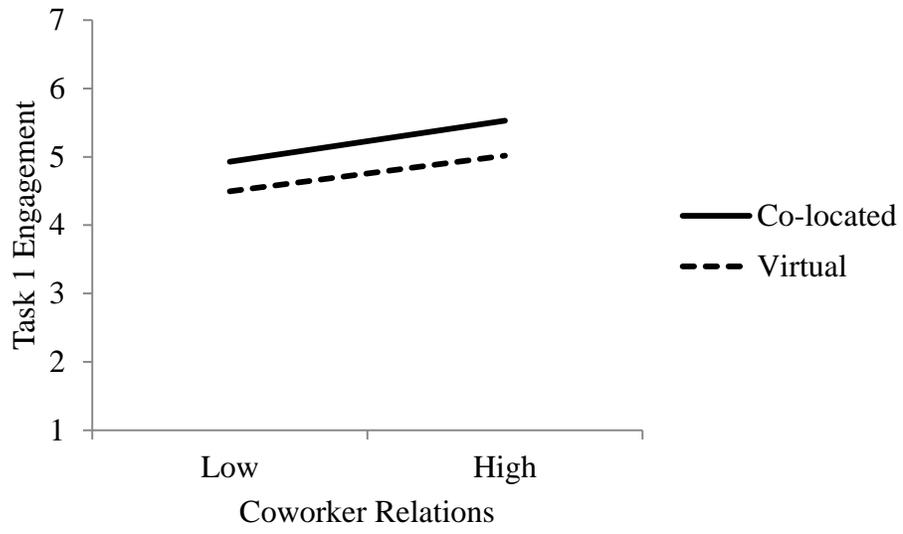
***p* < .01

Figure 1. Model of work environment and task engagement on performance, effort, and task satisfaction.



Note. _a variable measured during Task 1 only
_b variable measured during Task 2 only
_c variable measured during both Task 1 and Task 2

Figure 2. Task engagement as a function of work environment and coworker relations.



Appendix A

Measures

Team Uncertainty

Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
1	2	3	4	5

This scale consists of a number of statements that may or may not describe your experience in today's study. Read each statement, and then mark the appropriate number in the space next to each item using the scale above.

During the discussion with my teammates...

1.	I knew how other team members felt about me.	1	2	3	4	5
2.	I knew my place in the team.	1	2	3	4	5
3.	I understood other team members' goals for the discussion.	1	2	3	4	5
4.	I was able to observe the effort other team members put forth.	1	2	3	4	5
5.	When other team members contributed, I understood their perspective.	1	2	3	4	5
6.	I could understand other team members' arguments.	1	2	3	4	5
7.	I was able to observe how other team members were acting to determine how I should behave.	1	2	3	4	5
8.	I could easily interpret information from other team members.	1	2	3	4	5

Social Presence

Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
1	2	3	4	5

The following items describe different feelings about your interaction with other team members during the marketing task. Read each statement and then circle the appropriate number in the space next to it in terms of the extent to which you agree or disagree with the statement.

When thinking about HOW I communicated with the other participants in this task (i.e., face-to-face or in a virtual chat)...

1.	Communication was impersonal (r)	1	2	3	4	5
2.	This study provided an excellent stage for social interaction	1	2	3	4	5
3.	I felt comfortable conversing with others	1	2	3	4	5
4.	I felt a sense of community with my team members	1	2	3	4	5
5.	I felt comfortable participating in discussions with other team members	1	2	3	4	5
6.	Discussions in this study tended to be impersonal (r)	1	2	3	4	5
7.	I felt comfortable interacting with other participants in this study	1	2	3	4	5
8.	I felt that my point of view was acknowledged by other participants in this study	1	2	3	4	5
9.	I was able to form distinct individual impressions of other participants in the study	1	2	3	4	5

Coworker Relations

Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
1	2	3	4	5

This scale consists of a number of statements that may or may not describe your experience in today's study. Read each statement, and then mark the appropriate number in the space next to each item using the scale above.

1.	My interactions with the other team members on this task were rewarding	1	2	3	4	5
2.	My team members value my input	1	2	3	4	5
3.	My team members and I have a mutual respect for one another	1	2	3	4	5
4.	I trust my other team members	1	2	3	4	5
5.	My team members considered your viewpoint.	1	2	3	4	5
6.	My team members treated you with kindness and consideration.	1	2	3	4	5
7.	My team members treated me with respect.	1	2	3	4	5
8.	My team members refrained from improper comments or remarks.	1	2	3	4	5
9.	My team members showed concern for you as a part of the team.	1	2	3	4	5
10.	I would be interested in working with my team members on similar task in the future.	1	2	3	4	5
11.	I am looking forward to working with my team members on another task next week.	1	2	3	4	5

Task Engagement

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Using the scale above, please indicate the extent to which you agree or disagree with each of the following statements by circling your response on a scale from 1 (strongly disagree) to 7 (strongly agree) that most closely corresponds with your opinion.

IMPORTANT:

For the following questions, reflect on your performance during the team discussion. Rate each response based on your performance during this group discussion, not how you perform in general. Please respond to each question honestly. Your responses will not affect your performance ratings during the task.

1.	I worked with intensity on the task (removed)	1	2	3	4	5	6	7
2.	I exerted my full effort on the task (removed)	1	2	3	4	5	6	7
3.	I devoted a lot of energy to the task	1	2	3	4	5	6	7
4.	I tried my hardest to perform well on the task	1	2	3	4	5	6	7
5.	I strived as hard as I could to complete the task	1	2	3	4	5	6	7
6.	I exerted a lot of energy on the task	1	2	3	4	5	6	7
7.	I am enthusiastic about the task	1	2	3	4	5	6	7
8.	I feel energetic about the task	1	2	3	4	5	6	7
9.	I am interested in the task	1	2	3	4	5	6	7
10.	I am proud of my work on the task (removed)	1	2	3	4	5	6	7
11.	I feel positive about my work on the task (removed)	1	2	3	4	5	6	7
12.	I am excited about my work on the task	1	2	3	4	5	6	7
13.	My mind was focused on the task	1	2	3	4	5	6	7
14.	I paid a lot of attention to the task	1	2	3	4	5	6	7
15.	I concentrated on the task	1	2	3	4	5	6	7
16.	I focused a great deal of attention to the task	1	2	3	4	5	6	7
17.	I was absorbed by the task	1	2	3	4	5	6	7
18.	I devoted a lot of attention to the task	1	2	3	4	5	6	7

Effort

Please indicate the amount of effort you put forth during the task that you just completed by responding to the following questions.

Much Less Than Average	Slightly Less Than Average	Average	Slightly More Than Average	Much More Than Average
1	2	3	4	5

1.	Compared to other team members, how much time did you spend working on the task?	1	2	3	4	5
2.	Compared to other team members, how intensely did you work on the task?	1	2	3	4	5
3.	Compared to other team members, how much overall effort did you expend while working on the task?	1	2	3	4	5

Task Satisfaction

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Using the scale above, please indicate the extent to which you agree or disagree with each of the following statements by circling your response on a scale from 1 (strongly disagree) to 7 (strongly agree) that most closely corresponds with your opinion.

1.	I enjoyed working on the task in this study	1	2	3	4	5	6	7
2.	I am satisfied with the contributions I made to the task	1	2	3	4	5	6	7
3.	I enjoyed working with the other participants in this study	1	2	3	4	5	6	7
4.	I am satisfied with my performance on this task	1	2	3	4	5	6	7
5.	I am proud of the work my team did on this task	1	2	3	4	5	6	7
6.	I would like to work for Travel University on a similar task in the future	1	2	3	4	5	6	7

Appendix B

Task Performance Competencies and Definitions

Competency	Definition
Leading and Initiating	Takes control and exercises leadership over the group. Initiates action, gives direction and takes responsibility for the progress of the group toward its objectives. Directs the conversation flow; facilitating participation and blocking those who monopolize the discussion; encouraging those who haven't spoken yet to speak; uses open-ended questions to draw out quieter members; creating opportunities for others to speak.
Creating and Conceptualizing	Works well in situations requiring openness to new ideas and conceptualizing experiences. Handles situations and problems with innovation and creativity. Proposes an idea or way to generate ideas; offering facts or ideas; building on others' ideas by contributing an additional point.
Supporting and Cooperating	Supports others and shows respect for them. Summarizes and reinforces contributions to the team; is willing to compromise with others to help the team reach a solution; reduces tension within the group by using humor; explores differences between ideas; expresses ways to integrate different ideas.
Interacting and Presenting	Communicates effectively with other team members; Clearly presents ideas; Responds to criticism or questions about ideas; Successfully persuades and influences others of the merits of an idea; Convinces other team members to alter their position in considerate of an alternate idea.
Organizing and Executing	Plans ahead, works in a systematic and organized way. Is able to take the marketing idea generated and create a systematic plan that would lead to its successful implementation.

Appendix C

Observational Rating Form for Marketing Task

1. Competency: ***Leading and Initiating***

- Takes control and exercises leadership over the group. Initiates action, gives direction and takes responsibility for the progress of the group toward its objectives. Directs the conversation flow; facilitating participation and blocking those who monopolize the discussion; encouraging those who haven't spoken yet to speak; uses open-ended questions to draw out quieter members; creating opportunities for others to speak.

1	2	3	4	5
<i>Needs Improvement</i>	<i>Below Expectations</i>	<i>Meets Expectations</i>	<i>Exceeds Expectations</i>	<i>Exceptional Performance</i>
<p><i>-Behavioral Indicator Examples-</i></p> <ul style="list-style-type: none"> • Serves more of a background or peripheral role. Only responds when explicitly asked by other group members. • Does not take initiative over the group's tasks. • May only provide input after he/she is called upon by another group member. 				<p><i>-Behavioral Indicator Examples-</i></p> <ul style="list-style-type: none"> • Emerges as a clear leader in group discussions. Directs the conversation flow; facilitating participation and blocking those who monopolize the discussion; encouraging those who haven't spoken yet to speak; using open-ended questions to draw out quieter members; creating opportunities for others to speak • Prefers to take control or manage the work of the group.

Note: Competencies 2-3 had tables formatted similar to the first competency, but to save space just the anchors for 1 (needs improvement) and 5 (exceptional performance) are listed below.

2. Competency: ***Creating and Conceptualizing***

Works well in situations requiring openness to new ideas and conceptualizing experiences. Handles situations and problems with innovation and creativity. Proposes an idea or way to generate ideas; offering facts or ideas; building on others' ideas by contributing an additional point.

1: Needs Improvement

- Does not propose any ideas for marketing the company, Or idea(s) that he/she proposes lack originality (e.g., place a classified ad in the University's newspaper).
- Suggestions fail to address local university market.

5: Exceptional Performance

- Generates significant innovative or novel ideas for marketing the company. Significant ideas are those of substantial quality and/or quantity.
- Generates ideas that are unique to local university market

3. Competency: ***Supporting and Cooperating***

Supports others and shows respect for them. Summarizes and reinforces contributions to the team; is willing to compromise with others to help the team reach a solution; reduces tension within the group by using humor; explores differences between ideas; expresses ways to integrate different ideas.

1: Needs Improvement

- Is unwilling to alter his/her ideas to arrive at a solution that will benefit the team.
- Is disrespectful to other team members by failing to consider their ideas.
- Criticizes other team members by making general negative statements about them.

5: Exceptional Performance

- Helps resolve any barriers in the group's progress by altering his/her ideas to arrive at a solution that is best for the team.
- Shows respect for other team members by listening and considering their ideas.
- Reinforces the effort of other team members by noting the positive aspects of their ideas.

Note: Competencies 4-5 had tables formatted similar to the first competency, but to save space just the anchors for 1 (needs improvement) and 5 (exceptional performance) are listed below.

4. Competency: ***Interacting and presenting***

Communicates effectively with other team members; Clearly presents ideas; Responds to criticism or questions about ideas; Successfully persuades and influences others of the merits of an idea; Convinces other team members to alter their position in considerate of an alternate idea.

1: Needs Improvement

- Cannot clearly articulate the strengths of one's own or another's contribution(s).
- Arguments (if made) do not convince other team members to consider another point of view.

5: Exceptional Performance

- Clearly articulates the strengths of one's own or another's contribution(s).
- Persuades others to consider a different viewpoint.

5. Competency: ***Organization and execution***

Plans ahead, works in systematic and organized way. Is able to take the marketing idea generated and create a systematic plan that would lead to its successful implementation.

1: Needs Improvement

- Ideas for implementation are poorly organized. Implementation plan is not clearly articulated.
- Does not provide an implementation plan that would lead to a successful marketing strategy for Travel University.

5: Exceptional Performance

- Is able to define discrete components of the marketing idea. Implementation plan is laid out (i.e., presented) in a clear, systematic manner.
- Provides a very thorough and systematic implementation plan that would very likely lead to a successful marketing strategy for Travel University.

Appendix D

Travel University Information Sheet

TRAVEL UNIVERSITY.COM

It's your world. Explore It.

About Us

Travel University is the online travel service that enables students to travel for less. By negotiating with travel agencies on their behalf, Travel University provides college students with exclusive, significantly discounted travel services. Travel University is based in Fort Collins, Colorado with an additional location in College Station, Texas.

What We Offer

Our "Five Spheres" of travel service include:

- Airfare discounts (to worldwide destinations on all major US and European Airlines)
- Train discounts (including Amtrak, Eurail, and Rail Europe)
- Bus discounts (including Greyhound, Chinatown buses, and European Bus Service)
- Lodging discounts (in the US and Europe)
- Destination Guides

Additionally, we also offer special deals on Spring Break and Group Travel.

We Need Your Help!

Before we launch our new state-of-the-art website later this summer, we need your help to brainstorm some creative *marketing* and *promotional* ideas for Travel University. Because YOU (as college students) are our target audience, we are conducting focus groups around several Northern Colorado universities. Your task in this focus group is to come up with inspired ways to market and promote our new service.

- **Marketing:** How can we get the news out about Travel University? What should we emphasize? Where should we market and advertise about the amazing services we provide? What would convince you to use Travel University?
- **Promotion:** We also want to get your input on some innovative ways to promote our website. What specials or give-away prizes would persuade you to travel with us? Should we offer any special promotions throughout the year for specific students?

Since two heads are better than one, after working on this task by yourself you will then work in groups to come up with the best two ideas from your group's individual members. The group with the best ideas will be eligible for a random prize drawing!

Thank you and Good luck!