Development of the Team Virtuality Index (TVI)

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Abstract

This dissertation focuses on the creation of a measure of team virtuality and compares it with the individual outcomes of satisfaction and engagement. It begins with a brief introduction of the current trends regarding virtual teams and the lack of a consensus around the definition and measurement of the dimensions of virtuality. In the literature review, I outline the most common dimensions of virtual teams and provide a foundation for further exploration of virtuality. Based on these dimensions, I created and tested a seven-item Team Virtuality Index (TVI), which was ultimately refined to five dimensions. The TVI includes the dimensions of geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance. The TVI addresses a significant gap within the existing literature by providing for a consistent measure of team environments and giving researchers the ability to compare outcomes based on this environment. Within this research, I compared the level of team virtuality with the individual outcomes of satisfaction and engagement. Additional analysis investigated the influence of individual and team tenure, face-to-face meetings, and training. Noteworthy findings included the fact that the distinction between traditional and virtual teams may no longer be valid. All teams fall somewhere on the virtuality continuum. Additionally, face-to-face meetings may not be critical drivers of individual satisfaction and engagement when teams have a significant amount of experience working together. Virtual team training remains an area of opportunity. Further research is needed to test, refine, and validate the TVI.
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Chapter 1: Introduction

Given the rapidly changing work environment and numerous advances in communication technologies, the use of virtual teams continues to expand in many organizations. Work is shifting from someplace one goes to something one does (Ahuja, 2010). It can be performed anywhere at any time. Early on, there were many constructs used to describe this phenomenon, including work discontinuities (Chudoba, Wynn, Lu, & Watson-Manheim, 2005), dispersed teams, working remotely, telecommuting (O'Leary & Cummings, 2007), and virtual teams (Lurey & Raisinghani, 2001). The recent literature indicates that the use of virtual teams is wide-spread, with some researchers arguing that virtual teams have replaced traditional teams within many organizations (Gibson, Huang, Kirkman, & Shapiro, 2014; Peñarroja, Orengo, Zornoza, & Hernández, 2013). With this change, there has been a growing body of literature and research around this topic.

However, one of the key challenges within the field is that there is little agreement on exactly what characteristics and attributes define a virtual team. Some of the most common descriptions include geography, task interdependence, reliance on communication technologies, and differences in time zones. However, many other characteristics are used throughout the literature. There is a lack of clarity and specificity within the field on what is meant by “virtual team” (Shuffler, Wiese, Salas, & Burke, 2010). Gibson and Gibbs (2006) have contended that the term “virtual” has
been used inconsistently within the field, and that the types of teams characterized within the research as virtual are quite different.

Beyond the need to identify common attributes or dimensions of virtual teams, there is also a lack of a measure regarding the extent of these dimensions. A way to quantify the level of “virtualness” would help us understand the extent of these dimensions and allow us to better compare organizational and team environments. Rather than characterizing teams as face-to-face or virtual, there is a need to measure the level of virtuality (Purvanova & Bono, 2009). Virtuality and the measure of virtuality have received some attention within the field; however, there is a need for a clear definition of the construct (Ayoung, Kyung-Shik, Manju, & Min Soo, 2011).

The purpose of this dissertation is to build upon the existing literature and create a more precise definition of virtual teams. In this process, I will define the key dimensions that characterize virtual teams and develop and instrument to measure the extent of these dimensions. This will give researchers the ability to compare virtual team environments and investigate the relationship to both individual and team outcomes.

In this chapter, I will provide a brief overview of the organizational trends regarding virtual teams. This will include reviewing some of the key drivers for this growing trend as well as some of the advantages of using virtual teams for both organizations
and individuals. I will also explore how virtual teams have been defined and some of the current challenges related to a lack of agreement on a common definition. I will introduce the construct of virtuality, which is used to define to what extent a team is virtual. Lastly, I will provide an overview of the purpose of my research and this dissertation.

**Organizational Trends Regarding Virtual Teams**
The use of virtual teams began several decades ago. Back in 2004, Powell, Piccoli, and Ives (2004) recognized that virtual teams could significantly alter modern organizations, providing high levels of responsiveness and agility. Large organizations began to utilize virtual teams in a variety of settings. Around the same time, Kirkman and Mathieu (2005) argued that in many organizations, traditional teams (purely face-to-face) were no longer the norm. “Virtual work is becoming as common as face-to-face work,” (Webster & Staples, 2006, p. 182). Since that time, there have been major advances in communication technologies and a continuing change in the workplace. In 2016, CultureWizard (2016) administered a survey, titled *Trends in Global Virtual Teams*, to over 1300 participants in 80 countries. In this survey 85% of the respondents indicated that they work as part of a virtual team. CultureWizard (2016) has been conducting this annual survey for a number of years, and, in 2016, they went so far to say that “we cannot overstate the importance of virtual team work inasmuch as it is the basis of how global business is conducted today” (p. 3).
There are numerous reasons for this trend, ranging from technological advancements to the changing nature of teams. Lepsinger and DeRosa (2015) described the expanded boundaries of the modern office and its efficiency in virtuality:

[T]he modern office is increasingly defined by time zones, rather than walls...66 percent of multinationals, not to mention almost half of all organizations, use virtual teams, which can boost productivity and employee flexibility while reducing the time and cost of travel. (p. 2)

Nunamaker Jr, Reinig, and Briggs (2009) outlined the drivers of virtual teams, including business trends towards outsourcing, the proliferation of advanced communication technologies, competitive environments, shorter project timelines, decentralized decision making, and travel expenses.

Virtual team advantages
Organizations see many advantages to the use of virtual teams. They believe they can leverage the most qualified individuals regardless of location (Hunsaker & Hunsaker, 2008). This might mean using internal, geographically dispersed resources from another location, or it could mean recruiting specialized individuals outside of the normal recruiting channels. Ford, Piccolo, and Ford (2016) attributed the increase in use of virtual teams as an organizational response to the need to solve business challenges that cross traditional organizational boundaries. Problems can be addressed by those individuals possessing the best skills and capabilities regardless of their geographic location.


**Definitions of Virtual Teams**

While there has been a substantial increase in both the utilization and academic exploration of virtual teams, there remain significant opportunities for increased understanding. Virtual teams have been characterized in a variety of ways within the literature. One of the earliest definitions came from Lurey and Raisinghani (2001), who described virtual teams as having limited face-to-face interactions and relying primarily on communication technologies for collaboration. As the field has advanced, the definitions have evolved. Horwitz, Bravington, and Silvis (2006) defined virtual teams as geographically dispersed individuals working interdependently towards shared outcomes through communication technologies.

One of the major opportunities in advancing the study of virtual teams is to clarify how the construct of virtual team has been operationalized within the field. Numerous researchers have called out this fact. There is little agreement on the definition of virtual teams (Fiol & O'Connor, 2005). There remains a lack of a common definition of virtual teams (Ahuja, 2010). Gibson and Gibbs (2006) explained that “the term virtual has been applied imprecisely in the literature to represent very different types of teams” (p. 453). While the definition of the *virtual* aspect of virtual team remains elusive, there is consensus regarding the *team* aspect. That is, that virtual teams are teams *first*, with many of the same challenges of any traditional team (Martins, Gilson, & Maynard, 2004). The tasks, goals, and priorities of virtual teams are the same as face-to-face teams (Bell & Kozlowski, 2002).
Another significant aspect of the initial research within the field is the attempt to treat virtual teams as a distinct type of team in contrast to face-to-face teams (Hoch & Kozlowski, 2014). Bell and Kozlowski (2002) further stated that the “literature has tended to treat virtual teams as a single, ‘ideal’ type, yet there are several dimensions or characteristics that vary among and distinguish different types of virtual teams” (p. 16). Teams were classified as being either virtual or face-to-face. More recently, there is a shift away from this dichotomous approach, viewing virtual teams as being more on a continuum (Griffith, Sawyer, & Neale, 2003; Orhan, 2014). For the purpose of this research, a virtual team is defined as an interdependent group of geographically and/or time dispersed individuals working toward common goals through the use of communication technologies (Hertel, Geister, & Konradt, 2005; Powell et al., 2004).

**The Construct of Virtuality**

The construct of virtuality attempts to explain the extent of virtualness on a given team. Peñarroja et al. (2013) argued that teams cannot be directly classified as virtual or traditional—virtuality is becoming a team characteristic. Furthermore, virtuality can be applied to just about every team to a certain extent (Orhan, 2014). Similar to the challenge with the construct of virtual teams, virtuality suffers from the same lack of a consistent and agreed upon definition. Schweitzer and Duxbury (2010) indicated that research that operationalizes the construct of virtuality is rare. Hosseini, Zuo, Chileshe, and Baroudi (2015) contended that in order to advance our understanding of virtual teams, consensus on the construct of virtuality within the field is a critical priority. Gilson, Maynard, Jones Young, Vartiainen, and Hakonen (2015) argued that
“a first step is to derive a more unified measurement and treatment of the construct [virtuality], which would allow for comparisons to be made across studies” (p. 1317).

**Research Purpose**

While there has been significant research on virtual teams, the research has not only lacked a consistent operationalization of the construct of virtuality, but it has also not taken into account the different degrees of virtuality (Foster, Abbey, Callow, Zu, & Wilbon, 2015). In one of the most comprehensive literature reviews of virtuality, Gibson et al. (2014) reviewed 392 papers published between 2000 and 2013, and they found that 95% of the papers included more than one dimension of virtuality, with geographic dispersion and technological reliance being the most common. Clearly there is recognition within the field that virtuality is a multidimensional construct. However, within the empirical research, they found that 90% of the studies utilized only one dimension to operationalize virtuality (Gibson et al., 2014).

The purpose of this research is address one of the fundamental gaps in the existing literature—to create a consistent definition and measurement of team virtuality. After an extensive review of previous research, I have identified seven core dimensions that I will include in my definition of team virtuality, including geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. My intention is to operationalize each of these dimensions and develop a measure to capture the extent of each one within a given team environment. I am defining geographic dispersion as the physical distance
between individuals. This will be measured using the scale created by Schweitzer and Duxbury (2010), which calculates scores based on the time it would take to travel and meet face-to-face. Temporal dispersion is defined as the differences in time zones associated with the team. I am measuring this dimension by looking at the number of work hours that overlap between each team member. Isolation represents the amount of time spent working alone without the opportunity for face-to-face interactions with any other member of the team. I will measure this dimension looking at the number of days each week each member of the team works in a location separate from any other team member. I am defining imbalance as the differences in the number of team members at each location. I am measuring this dimension by capturing the number of work locations and the number of team members at each location. Technological reliance reflects the amount of work that is accomplished through the use of communication technologies. I will measure this dimension by capturing the total amount of work completed and the percentage completed through the use of communication technologies. Communication richness describes both the quantity and quality of the communication based on Media Richness Theory, which was created by Daft and Lengel (1986). To measure communication richness, I utilize the method used by Ganesh and Gupta (2010). In their study, for each type of communication tool, they rated the level of media richness and the frequency of use. Lastly, I define leader distance as the physical distance between a team member and the formal team leader. I propose to measure it using the same scale used for geographic dispersion.
Based on the results from each of these measures, I will create a composite score or virtuality index for any team environment. Using this measurement, I will answer the following question: To what extent is a given team virtual? Based on this result, I will also investigate how the level of virtuality influences the individual outcomes of job satisfaction and engagement. Additionally, I will explore the effect of several moderating variables that may influence these outcomes. The moderating variables include the amount of time an individual has been a part of the team (individual tenure), the amount of time the team has been in existence (team tenure), the number of face-to-face team meetings, and the amount of training a team has received related to working in a virtual environment.

**Chapters 2 through 5**
The following is a brief explanation of the forthcoming chapters in this dissertation. Chapter 2 is a detailed literature review on both virtual teams and the construct of virtuality. The literature on virtual teams focuses on how they have been described along with a detailed look at the most common definitions. Virtual teams are defined using different characteristics or dimensions. These dimensions include items such as geography, time zones, and the use of technology. Virtuality is a construct referring to the varying degrees of these dimensions. Virtual teams are viewed as multi-dimensional, and all teams possess these attributes to some extent. The next section in Chapter 2 reviews the literature that supports each of the seven core dimensions that I include in my definition of team virtuality, which are geographic dispersion, temporal
dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. Chapter 2 then reviews the literature related to those items that influence team outcomes, including the amount of time an individual has been a part of the team (individual tenure), the amount of time the team has been in existence (team tenure), the number of face-to-face team meetings, and the amount of training a team has received related to working in a virtual environment. Lastly, Chapter 2 includes literature related to the individual outcomes of satisfaction and engagement.

Chapter 3 outlines my research questions, hypothesis, and methodology. At a high level, my research attempts to answer the following questions: To what extent is a team virtual, and how does this influence individual satisfaction and engagement? In order to measure this, I define each of the seven dimensions included in my virtuality index and describe how each one is measured and calculated. I provide a thorough review of my survey instrument and scoring, along with the validated items used to measure satisfaction and engagement. Additionally, I outline my main effect hypothesis as well as my moderating hypothesis. Lastly, I introduce a sample model outlining the relationships between the independent, dependent, and moderating variables.

Chapter 4 summarizes the results of the data analysis. I provide an overview of the descriptive statistics of the sample population, including information on the sample size, gender, age, and ethnicity of the participants. I then summarize the findings
related to the measure of team virtuality. After testing multiple combinations of dimensions, a five-item measure was ultimately selected as the best fit to capture the extent of team virtuality: geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance. I then provide a summary of the results for each of the hypotheses. This includes the main effect hypotheses, which explore the relationship between team virtuality, job satisfaction, and engagement, as well as the moderating hypotheses, which explore the influence of team and individual tenure, team face-to-face meetings, and training.

Chapter 5 discusses the findings and key contributions of this research. It starts with a review of the Team Virtuality Index (TVI) by outlining the five dimensions included in the model and the two dimensions not included from the original conceptual design. I then provide a review and explanation of the high satisfaction and engagement scores within this sample. Following that, I summarize and elaborate on the findings related to each of the moderating variables. This includes discussing the influence of the high level of tenure within a virtual environment for both individuals and at the team level. I also discuss whether or not face-to-face meetings are critical drivers of individual satisfaction and engagement within a virtual environment. I review the findings and opportunities related to virtual team training and discuss whether or not the construct of a traditional team—working in a completely face-to-face environment—is still valid. I include a discussion looking at the results from a group development perspective, where I argue that the groups within this study were
likely operating at a higher stage of development, thus contributing to the high levels of satisfaction and engagement. Lastly, I summarize the limitations within this research.

Chapter 6 describes future research opportunities along with several implications for practitioners. First and foremost, additional research and investigation is needed for the Team Virtuality Index (TVI). This includes testing the current dimensions as well as identifying and exploring additional dimensions to refine the instrument. Another key research opportunity is to examine the virtual team development process to understand whether it aligns with traditional development models or if a different framework is needed. Lastly, I briefly outline research opportunities around generational differences, technology, and innovation. The implications for practice include recommendations on adopting workplace flexibility practices, utilizing face-to-face meetings up-front, and expanding the amount of virtual team training.
Chapter 2: Literature Review

This chapter includes a detailed literature review regarding both virtual teams and the construct of virtuality. The section on virtual teams outlines how virtual teams have been described in the literature, including a summary of the most commonly referenced definitions. Within these definitions, virtual teams are characterized using different dimensions, such as geography, time zones, or technology usage. The literature on virtuality approaches virtual teams as a multi-dimensional construct with varying degrees of each dimension. The next section in this chapter reviews the literature and support for each of the seven core dimensions I include in my definition of team virtuality: geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. Next, I review the literature related to those items that influence team outcomes, including the amount of time an individual has been a part of the team (individual tenure), the amount of time the team has been in existence (team tenure), the number of face-to-face team meetings, and the amount of training a team has received related to working in a virtual environment. Lastly, I include a summary of the literature supporting the individual outcomes of satisfaction and engagement.
Perspectives on Dimensions and Definitions of Virtual Teams

For the past several decades, there has been a growing body of literature around virtual teams. Bell and Kozlowski (2002) described virtual teams as working together over time and distance through the use of electronic media to accomplish their goals. Hertel et al. (2005) defined virtual teams as teams with two or more people who work together to accomplish shared objectives with at least one team member who works in a different location, organization, or time zone thus communication and collaboration takes place through the use of communication technologies. Lin, Standing, and Liu (2008) defined virtual teams as interdependent teams, dispersed across time and space, working a project facilitated by the use of communication technologies. According to Ferreira, Lima, and da Costa (2012), virtual teams are geographically, organizationally, and time dispersed workers who utilize communication technologies to accomplish organizational objectives. Orhan (2014) described virtual teams as geographically dispersed members who rely on communication technologies to accomplish their tasks. Lastly, Ford et al. (2016) characterized virtual teams as being geographically and/or organizationally dispersed individuals who primarily accomplish their goals through the use of communication technologies. Table 1 provides a summary of frequently cited definitions of virtual teams.
Table 1. Virtual Team Definitions

<table>
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<tr>
<th>Author(s)</th>
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<tr>
<td>Lipnack and Stamps (1997)</td>
<td>Virtual teams comprise people who interact via communication technology for the completion of interdependent tasks guided by a common purpose, working remotely, in different time zones and organizations.</td>
</tr>
<tr>
<td>Lurey and Raisinghani (2001)</td>
<td>Virtual teams are defined as teams having limited face-to-face interaction and relying primarily on communication technologies for collaboration.</td>
</tr>
<tr>
<td>Bell and Kozlowski (2002)</td>
<td>Virtual teams work together over time and distance via electronic media to combine effort and achieve common goals.</td>
</tr>
<tr>
<td>Kirkman, Rosen, Tesluk, and Gibson (2004)</td>
<td>Virtual teams are defined as groups of employees with unique skills, situation in distant locations, whose members must collaborate using technology across space and time to accomplish important organizational tasks.</td>
</tr>
<tr>
<td>Martins et al. (2004)</td>
<td>Virtual teams use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task.</td>
</tr>
<tr>
<td>Powell et al. (2004)</td>
<td>Virtual teams are groups of geographically, organizationally and/or time dispersed workers brought together by information and telecommunication technologies to accomplish one or more organizational tasks.</td>
</tr>
<tr>
<td>Hertel et al. (2005)</td>
<td>Virtual team members are geographically dispersed and coordinate their work predominantly with electronic information and communication technologies.</td>
</tr>
<tr>
<td>Gibson and Gibbs (2006)</td>
<td>Virtual teams are defined as geographically dispersed, electronically dependent, dynamic, or comprising diverse members who work remotely.</td>
</tr>
<tr>
<td>Horwitz et al. (2006)</td>
<td>Virtual teams are defined as geographically dispersed individuals, working interdependently towards shared outcomes, through communication technologies.</td>
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<tr>
<td>Author(s)</td>
<td>Definition</td>
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<tr>
<td>Peters and Manz (2007)</td>
<td>Virtual teams are comprised of members who might be located in a couple of geographical positions while working extensively with computer-mediated tools as the main channels for communications.</td>
</tr>
<tr>
<td>Kanawattanachai and Yoo (2007)</td>
<td>Virtual teams are geographically dispersed, temporary teams who rely on the use of communicational technologies for collaboration.</td>
</tr>
<tr>
<td>Hunsaker and Hunsaker (2008)</td>
<td>Virtual teams as group of geographically or organizationally dispersed individuals, who utilize communication and information technologies to complete organizational tasks.</td>
</tr>
<tr>
<td>Lin, Standing, and Liu (2008)</td>
<td>Virtual teams as interdependent teams, dispersed across time and space, working a project facilitated by the use of communication technologies.</td>
</tr>
<tr>
<td>Schweitzer and Duxbury (2010)</td>
<td>A virtual team must have members who do not work in either the same place and/or at the same time, and therefore cannot collaborate face-to-face all of the time.</td>
</tr>
<tr>
<td>Arling and Subramani (2011)</td>
<td>Distributed teams in organizations comprise members who are dispersed across physical locations and who use information and communication technology (ICT) to accomplish their tasks.</td>
</tr>
<tr>
<td>Ferreira, Lima, and da Costa (2012)</td>
<td>Virtual teams can be defined as a group of geographically, organizationally and time dispersed workers brought together by information technologies to accomplish one or more objectives of the organization.</td>
</tr>
<tr>
<td>Ortiz de Guinea, Webster, and Staples (2012)</td>
<td>Virtual teams are defined as groups of individuals who work together in different locations on interdependent tasks, sharing the responsibility for outcomes, while relying on technology to provide most of their communications.</td>
</tr>
<tr>
<td>Ghaffari, Sheikhammad, and Safakish (2014)</td>
<td>Virtual teams are people with unique skills who are separated in terms of geography and should use technological mediums for communications.</td>
</tr>
<tr>
<td>Orhan (2014)</td>
<td>A virtual team is defined as a group of people, composed of members that are geographically dispersed and mostly dependent on electronic communication.</td>
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Virtual teams are groups of two or more geographically and/or organizationally dispersed people who are coordinated primarily through a combination of telecommunications and communication technologies to accomplish a command a valued goal.

Virtual teams are conceptualized as interdependent groups which span physical and organizational boundaries and are dependent on technology for communication and proper functioning.

While geographic dispersion, temporal dispersion, and the use of technology are used frequently to describe virtual teams, there are some additional dimensions mentioned in the literature. Kirkman et al. (2004) used some the common dimensions in their definition of virtual team; however, they added an additional dimension of employees with unique skills as they defined virtual teams as groups of employees, who are dispersed across both time and geography, with unique skills, working towards common tasks facilitated through the use of communication technologies. In looking at the growing trend of virtual teams, one of the benefits identified was that organizations could select the most qualified or perhaps uniquely skilled employee to join a project team (Hunsaker & Hunsaker, 2008).

Kanawattanachai and Yoo (2007) also shared some of the common dimensions, including geographically dispersed and the utilization of communication technologies; however, they also defined virtual teams as temporary. Based on this definition, members do not have established relationships and may only have a
limited amount of time working together. In a somewhat similar way, Gibson and Gibbs (2006) characterized virtual teams as dynamic, meaning the team members change frequently.

With so many varying definitions of virtual teams, it may be helpful to outline those dimensions mentioned thus far, including those cited in Table 1:

- Geographic dispersion
- Temporal dispersion
- Technological reliance
- Limited face-to-face interaction
- Unique skills
- Relational boundaries
- Dynamic
- Interdependent
- Temporary
- Organizationally dispersed

As indicated earlier, the most frequently referenced dimensions specifically related to being in a virtual environment are geographic dispersion, temporal dispersion, and the use of technology. The reason these dimensions are consistently included within most definitions is that they apply in the majority of virtual environments. Dimensions such as temporary or dynamic (i.e., members change frequently) may only be true in certain circumstances.
**Traditional team components**

With the varying definitions of virtual teams, there is some consistency and agreement in the nature of virtual teams. In other words, virtual teams share the same goals and priorities of “traditional” face-to-face teams, such as (1) interdependence (Horwitz et al., 2006; Kramer et al., 2017; Lin et al., 2008; Ortiz de Guinea et al., 2012; Schweitzer & Duxbury, 2010), (2) shared efforts towards organizational tasks (Arling & Subramani, 2011; Hunsaker & Hunsaker, 2008; Kirkman et al., 2004; Martins et al., 2004; Powell et al., 2004), (3) collaboration (Kanawattanachai & Yoo, 2007; Kirkman et al., 2004; Lurey & Raisinghani, 2001), and (4) shared efforts towards common organizational goals (Bell & Kozlowski, 2002; Ferreira et al., 2012; Ford et al., 2016; Hertel et al., 2005).

**Perspectives on Dimensions and Definitions of Virtuality**

Beyond the uncertainty surrounding the dimensions that should be included in the definition of virtual teams, there is also a challenge around the degree of many of these dimensions. In today’s organizations, it is hard to define teams as either traditional or virtual. The construct of virtuality can help us understand the extent of these dimensions and allow us to better compare organizational and team environments. Within the literature, the majority of researchers have characterized teams in a dichotomous way as being either virtual or co-located (Ortiz de Guinea et al., 2012). Very few studies attempt to define and measure the extent of team virtuality. This section includes a review of the research where there was an attempt to measure the extent of team virtuality.
Gibson and Gibbs (2006) defined virtuality as a multidimensional construct that includes four independent attributes: geographic dispersion, electronic dependence, dynamic structural arrangements, and national diversity. While these attributes are common in many of the working definitions of virtuality, they are unique given that they are treated as independent characteristics rather than taken as a collective. All dimensions are on a continuum. A team with members in multiple states would be more disperse than a team with multiple locations within a single state. Dynamic structural arrangements characterize the types of teams and roles within today’s organizations. An individual on a long-term or permanent team would be in a different place on the continuum than an individual working as a part of several short-term project teams. For their study, they used qualitative research, which included 14 teams that spanned 16 international organizations located across the globe.

Geographic dispersion was measured by taking into account the number of locations and the number of people in each location. Information gathered from interviews was coded and then used to determine the level of electronic dependence. Raters indicated low, moderate, or high level of dependence based on the interview data. For the measurement of dynamic structural arrangements, raters used historic documents, including organizational charts, team lists, and company records, to indicate whether the structure had not changed, changed, or significantly changed. Lastly, national diversity was measured using team heterogeneity research to measure the nationalities within each team.
Chudoba et al. (2005) proposed a virtuality index to measure exactly how virtual a given environment is, based on geography, time zones, culture, work practices, organizational practices, and technology (see Table 2 for a list of items). After testing their original 18 item instrument, they refined it down to 12 items in three primary dimensions: (1) team distribution, which is the degree the team is geographically spread out; (2) workplace mobility, which is the amount of time working in areas outside of their normal office location; and (3) variety of practices, which is the degree of culture and work process diversity experienced by team members (Chudoba et al., 2005). Each of the items was measured on a six-point frequency scale indicating how often they experienced the item. The scale included the choices of “daily,” “weekly,” “monthly,” “quarterly,” “yearly,” and “never.”

Table 2. Dimensions of Virtuality

<table>
<thead>
<tr>
<th>Team Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Collaborate with people in different time zones</td>
</tr>
<tr>
<td>• Work with people via internet-based conferencing applications</td>
</tr>
<tr>
<td>• Collaborate with people you have never met face to face</td>
</tr>
<tr>
<td>• Collaborate with people who speak different native languages or dialects from your own</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Workplace Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Work at different sites</td>
</tr>
<tr>
<td>• Have professional interactions with people outside the organization</td>
</tr>
<tr>
<td>• Work with mobile devices</td>
</tr>
</tbody>
</table>
• Work at home during normal business day
• Work while travelling (e.g., at airports or hotel)

**Variety of Practices**
• Work on projects that have changing team members
• Work with teams that have different ways to track their work
• Work with people that use different collaboration technologies

*Source: Adapted from Chudoba et al., 2005*

In their article on teams, O'Leary and Cummings (2007) provided the most comprehensive attempt to measure the level of geographic dispersion within a virtual team. They outlined and measured five characteristics associated with geographic dispersion, including (1) spatial, which is the measure of distance between individuals; (2) temporal, which looks at the time difference between team members; (3) site, which indicates the number of locations where team members work; (4) isolation, which characterizes the extent to which team members work alone; and (5) imbalance, which captures the distribution of team members at different locations (O'Leary & Cummings, 2007). For each characteristic, the authors calculated an index score based on the team configuration. While this research provides a more granular view of geographic dispersion, the authors have not provided a larger view of how the five dimensions relate to each other and incorporate into a larger measure of team dispersion. The other limitation within this research in the context of virtuality is that geographic dispersion is the only characteristic investigated. As described previously, there are many other potential dimensions, such as technology
use, organizational practices, diversity, etc., that may influence the level of team virtuality. Even with these limitations, the methods for measuring dispersion developed by O'Leary and Cummings (2007) are frequently used by other researchers attempting to measure the level of team virtuality (Anderson, McEwan, Bal, & Carletta, 2007; Arling & Subramani, 2011).

Recognizing the need for a more precise definition of virtuality, Schweitzer and Duxbury (2010) undertook the effort to define the construct with virtuality being measured on a continuum rather than considered only as a dichotomy. Based on their review of the literature, they found that the most common ways that virtuality is defined includes these four characteristics: (1) use of communication technology, (2) geographic placement, (3) boundary spanning and working with multiple organizational units, and (4) temporal factors such as time zones or varying work hours. However, they felt the literature did not accurately reflect the significant characteristics of virtual teams, so they defined virtuality around three alternative dimensions: (1) the amount of time individuals spend working alone, (2) the number of people on the team who work virtually, and (3) the degree of separation between the team members (Schweitzer & Duxbury, 2010). They measured the first dimension as the percentage of work time spent working virtually. This was calculated at the team level looking at the total number of virtual work hours divided by the number of total work hours. The number of people working virtually was measured by looking at the percentage of team members located in different offices. A team with 4
members at 2 offices would have a score of 50%. Lastly, the degree of separation was measured by calculating the distance members would need to travel to in order to meet face-to-face. As an example, to travel within the same city would be considered small (1/4 day or .25 score) and international travel much higher (3 days or 5.0 score).

**Table 3. Virtuality Definitions**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chudoba et al. (2005)</td>
<td>Virtuality is defined as the extent to which discontinuities and continuities are present in the work environment. There are six discontinuities that capture the distinctive aspects of a virtual environment: geography, time zone, culture, work practices, organization, and technology.</td>
</tr>
<tr>
<td>Kirkman and Mathieu (2005)</td>
<td>Team virtuality is defined using three dimensions: (a) the extent to which team members use virtual tools to coordinate and execute team processes (b) the amount of informational value provided by such tools, and (c) the synchronicity of team member virtual interaction.</td>
</tr>
<tr>
<td>Fiol and O’Connor (2005)</td>
<td>Virtualness is defined as the extent (or lack) of face-to-face contact among team members including both the amount of contact and the frequency.</td>
</tr>
<tr>
<td>Gibson and Gibbs (2006)</td>
<td>Virtuality is a multidimensional construct comprising four independent characteristics including geographic dispersion, electronic dependence, dynamic structural arrangements, and national diversity.</td>
</tr>
<tr>
<td>Dixon and Panteli (2010)</td>
<td>Virtuality is based on the construct of discontinuity, where a discontinuity reflects the perception of challenges communicating and interacting across a boundary. Examples of these boundaries include physical location, time-zone, and cultural differences.</td>
</tr>
<tr>
<td>Schweitzer and Duxbury (2010)</td>
<td>Virtuality includes the extent that the team members do not work face-to-face, the distance between team members, their configuration or colocation patterns, and the extent that they work asynchronously.</td>
</tr>
</tbody>
</table>
Andressen, Konradt, and Neck (2012) | Virtuality is defined as a continuous variable with two central aspects the frequency of computer-mediated communication (CMC) and physical distance which combine into one overall index.

Orhan (2014) | The degree of virtuality of teams is based on the level of face-to-face communications and electronic communication usage.

Hosseini, Chileshe, Zuo, and Baroudi (2015) | Virtuality is a holistic phenomenon that reflects to what degree there are deviations from face-to-face team conditions that affect the quality of communications within a team.

Ferretti (2016) | Virtuality is defined by the distribution of team members and the number of face-to-face meetings.

Kramer et al. (2017) | Virtuality is defined by the degree of reliance on virtual tools, information value of those tools, and synchronicity offered by these tools.

Much like the variation of the way virtual teams are defined within the literature, there is a similar challenge with virtuality. Table 3 summarizes the frequently cited definitions of virtuality, which includes the following dimensions:

- Use of virtual communication tools
- Information value of tools
- Synchronicity of communications
- Lack of face-to-face contact
- Geographic dispersion
- Electronic dependence
- Dynamic structural arrangements
- National diversity
• Discontinuities of physical location, time-zone and cultural differences
• Configuration or colocation patterns
• Asynchronous work
• Frequency of electronic communication
• Number of face-to-face meetings
• Team distribution
• Workplace mobility

As one would expect, in most cases, the virtuality dimensions are directly derived from those dimensions used to characterize virtual teams. The distinction is that the virtuality dimensions are recognized as being on a continuum rather than being characterized as present or not present. A team is not co-located or geographically dispersed, but rather the question becomes about to what extent the team members are geographically dispersed.

**Virtuality Measures Used in this Dissertation**

Building on the virtuality dimensions outlined by O'Leary and Cummings (2007), which included spatial (geographic distance between team members), temporal (time difference), isolation (amount of time team members work alone), and imbalance (site distribution of team members), I am including three additional dimensions in the measure of virtuality: technological reliance, communication richness, and leader distance. Technology is a key enabler in working within a virtual environment, so the
level of reliance is a key dimension to measure (Chudoba et al., 2005). Technological reliance considers the *quantity* of communication; however, communication richness describes the *quality* of the communication based on Media Richness Theory, created by Daft and Lengel (1986). Lastly, there is a unique dynamic based on leadership virtuality. Hoch and Kozlowski (2014) investigated hierarchical leadership within virtual teams, specifically examining leadership effectiveness as the level of team virtuality increased. The following section further explores the literature for each of these seven dimensions. Figure 1 provides an illustration of the literature support for each dimension.

**Geographic dispersion**
Geographic dispersion is the most frequently cited dimension in describing virtual teams. In the team environment, distance matters as it directly impacts spontaneous communications (O'Leary & Cummings, 2007). Chudoba et al. (2005) called geography “the nexus” of all descriptions of virtual team environments. Fiol and O'Connor (2005) characterized geographic dispersion as a defining element of virtualness to the extent that it limits team members from interacting face-to-face. Lack of face-to-face communication has been shown to cause decreases in team cooperation and efficiency (Kramer et al., 2017). Schweitzer and Duxbury (2010) included geographic distance in their measure of virtuality. They scored the distances based on the amount of time required to travel in order to meet face-to-face. Those locations in the same city received a lower score than locations in different regions of
the same country. After an extensive review of the current definitions and measures of virtuality, Ferretti (2016) outlined spatial distribution as one of two “universally applicable measures” of team virtuality. Anderson et al. (2007) called physical distance one the central aspects of virtuality. For this dissertation, I define geographic dispersion as the physical distance between individuals. I propose to measure it using the scale created by Schweitzer and Duxbury (2010), which determines the scores based on the time it would take to travel and meet face-to-face.

**Temporal dispersion**
The second dimension outlined by O'Leary and Cummings (2007) is temporal dispersion, defined by the extent in which team members normal work hours overlap. The implication of overlapping work hours or the lack there of, is the opportunity for synchronous or real-time communications. O'Leary and Cummings (2007) measured this dimension by taking the total number of sites and the total number of time zones represented on the team. At the most basic level, there are increased challenges in scheduling and coordination activities due to less overlapping work hours (Chudoba et al., 2005). Arling and Subramani (2011) argued that temporal dispersion is important because it reflects the increased difficulties that may happen given the varying work schedules. Ahuja (2010) conducted a study on the impact of virtuality on team performance. To measure temporal dispersion, this particular study utilized the instrument developed by Chudoba et al. (2005) and captured this dimension by asking team members how often they collaborated with people in different time zones. Responses were captured on a six-point scale ranging from daily to never. In
this research, I am defining temporal dispersion as the differences in time zones associated with the team. I am measuring this dimension by looking at the number of work hours that overlap between team members.

**Isolation**
For O'Leary and Cummings (2007), isolation captured the number of team members located at sites with no other team members. With today’s varying team configurations, such as regular work from home days, this does not seem to capture the full extent and impact of the dimension. Schweitzer and Duxbury (2010) went a bit further and described isolation as the amount of time that members work in a virtual capacity. In other words, there is a lack of opportunity for face-to-face interaction with other team members. Schweitzer and Duxbury (2010) measured this dimension by capturing the total weekly hours spent working virtually on team related tasks. Related to virtuality and indirectly related to isolation, Ferretti (2016) asked respondents a modified version of the question developed by O'Leary and Cummings (2007): *How would you describe most of your team members’ location having as a point of reference your place of work: same room in the same building, different building in the same city, different city or different country.* In this dissertation, I am defining isolation as the amount of time spent working alone without the opportunity for face-to-face interactions with any other member of the team. I will measure this dimension looking at the number of days each week that each member of the team works in a location separated from any other team member. This will allow me to capture those employees who work in a location with no other
team members as well as employees who occasionally work from home or in a separate location.

**Imbalance**
Closely related to the dimension of isolation is imbalance. That is, the number of team members at any given location. O'Leary and Cummings (2007) captured the 20 possible site configurations for an eight-member team. I have slightly modified their model in Table 4 to include a 21st site location with all the members in one location. In their research, Schweitzer and Duxbury (2010) identified co-location and configuration patterns as part of their view of virtuality. They captured the number of team members located at each site to understand member virtuality. Arling and Subramani (2011) used the term *configurational dispersion* to reflect the different work sites where individuals may be collocated with other team members or work alone. They measured this by looking at the total number of team members and the proportion of those members who were not collocated. In this dissertation, I am defining imbalance as the number team members at each location. I am measuring this dimension by capturing the number of work locations and the number of team members at each location.
Table 4. Potential Team Dispersion for Eight-Person Team

<table>
<thead>
<tr>
<th>Number of Locations</th>
<th>Team Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>7-1, 6-2, 5-3, 4-4</td>
</tr>
<tr>
<td>3</td>
<td>6-1-1, 5-2-1, 4-2-2, 3-3-2</td>
</tr>
<tr>
<td>4</td>
<td>5-1-1-1, 4-2-1-1, 3-3-1-1, 3-2-2-1, 2-2-2-2</td>
</tr>
<tr>
<td>5</td>
<td>4-1-1-1-1, 3-2-1-1-1, 2-2-2-1-1</td>
</tr>
<tr>
<td>6</td>
<td>3-1-1-1-1-1-1, 2-2-1-1-1-1</td>
</tr>
<tr>
<td>7</td>
<td>2-1-1-1-1-1-1-1</td>
</tr>
<tr>
<td>8</td>
<td>1-1-1-1-1-1-1-1</td>
</tr>
</tbody>
</table>

Source: Adapted from O’Leary and Cummings, 2007

Technological reliance

Given the rapid expansion of virtual teams, one of the driving forces has been the advances in communication technologies. Technology is a key enabler in working within a virtual environment, so the level of reliance is a key dimension to measure (Chudoba et al., 2005). The use of technology facilitates coordination of work and communication among team members (Ayoung et al., 2011). However, as it has been discussed, there is a blurring of the lines between traditional teams and virtual teams. The extent of just how virtual a team environment is can be better described using a continuum (Griffith et al., 2003). This is a prime dimension to illustrate this point as it can certainly be argued that in today’s environment, many traditional, purely face-to-face teams rely heavily on communication technologies in the course of their work activities.

In their conceptualization of virtuality, Arling and Subramani (2011) considered four dimensions: spatial dispersion, configurational dispersion, temporal dispersion, and
the use of communication technologies. In order to measure the use of communication technologies in their study, they captured the total number of hours spent communicating each week by looking at the proportion of total time communicating versus time spent communicating electronically. They did not capture the communication channel or attempt to measure any qualitative aspects of the communication, such as effectiveness or media richness.

In their article, “The Dimensions and Antecedents of Team Virtuality,” Kirkman and Mathieu (2005) supported the contention that team virtuality is a multi-dimensional construct. However, they argued that geographic dispersion should not be a defining characteristic of virtual teams. This is based on their observation that even co-located teams can operate through the use of communication technologies in a highly virtual manner. They defined the level of virtuality as being dependent on three dimensions: the level of use of virtual communication tools, the amount of informational value of these tools, and the level of synchronicity of team interactions (Kirkman & Mathieu, 2005). Put simply, their characterization of virtuality is “the more teams rely on virtual tools to work and communicate as opposed to face-to-face interaction, the higher the level of virtuality” (Kirkman & Mathieu, 2005, p. 703).

Hoch and Kozlowski (2014) measured the degree of team virtuality based on geographic dispersion, electronic communication usage, and cultural differences. In their measurement of electronic communication, they evaluated the frequency of
usage for e-mail, phone, instant messaging, video, and face-to-face interactions. In order to understand the frequency of electronic communication, they divided the sum of electronic communication by the sum of all communication. The authors did a thorough job a capturing the communication channels and providing an understanding into the level of electronic communication usage.

In this dissertation, technological reliance reflects the amount of work that is accomplished through the use of communication technologies. I will measure this dimension by capturing the total amount of work completed and the percentage completed through the use of communication technologies.

**Communication richness**
Within the literature, the amount of electronic communication in a virtual team environment has been a frequent topic of investigation and measurement (Arling & Subramani, 2011; Hoch & Kozlowski, 2014). However, few studies have looked at type and quality of the communication. Communication richness describes the quality of the communication based on Media Richness Theory, created by Daft and Lengel (1986). According to Daft and Lengel (1986), media richness is a function of (1) the medium’s ability to allow for immediate feedback, (2) the number of cues, and (3) the level of focus on the individual. This framework provides a useful methodology for investigating virtual interactions (see Table 5). In this dissertation, to measure communication richness, I will utilize the method created by Ganesh and Gupta
In their study, they rated the perceived level of media richness for each type of communication tool. They then calculated a virtualness score by looking at the frequency of use multiplied by the media richness rating for each tool.

### Table 5. Media Richness

<table>
<thead>
<tr>
<th>Richer Communication Mediums</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-Face</td>
</tr>
<tr>
<td>Live Video</td>
</tr>
<tr>
<td>Voice</td>
</tr>
<tr>
<td>Chat</td>
</tr>
<tr>
<td>Email Messages</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leaner Communication Mediums</th>
</tr>
</thead>
</table>

*Source: Adapted from Daft & Lengel, 1986*

**Leader distance**

The final dimension I include in my measure of virtuality is leader distance. While all of the dimensions are applied to each member individually, there is a unique dynamic with the relationship between each member and the team leader. Hoch and Kozlowski (2014) looked at hierarchical leadership and virtual teams, specifically examining leadership effectiveness as the level of team virtuality increased. For this dissertation, I define leader distance as the physical distance between a team member and the formal team leader. I propose to measure it using the same scale used for geographic dispersion, which is the scale created by Schweitzer and Duxbury (2010). In their
scale, scores are determined based on the time it would take to travel and meet face-to-face.

**Figure 1. Virtuality Dimension Sources**
Moderating Variables Used in this Dissertation

Face-to-face meetings
Early on, much of the research on virtual teams focused purely on their differences from traditional, face-to-face teams. Bell and Kozlowski (2002) identified the fact that many traditional teams rely heavily on technology to accomplish their goals, but it is the lack of face-to-face communications that characterizes a virtual team. According to Bell and Kozlowski (2002), the actual distance between team members is not as important as the effect of this distance. In a traditional setting, virtual communication tools are generally used to supplement face-to-face interactions. Within a virtual setting, the communication tools are the primary source of collaboration and communication.

Research has shown that teams with limited opportunities for face-to-face interactions may experience productivity losses and performance issues (Gibson & Cohen, 2003). The survey conducted by CultureWizard (2016) stated that “some personal, face-to-face contact is valuable and enhances productivity in global teams.” (p.15)

Furthermore, their survey respondents indicated that a lack of face-to-face contact had a negative impact productivity due to (1) individuals not understanding the full context of communications, (2) an inability to manage conflict, and (3) challenges around creating trust and building relationships.
Importance of face-to-face communication

There are a number of positive outcomes of face-to-face communication identified within the literature. Face-to-face interactions enable relationship development and mutual understandings (Dixon & Panteli, 2010). Face-to-face meetings help teams build trust and improve performance (Furst, Reeves, Rosen, & Blackburn, 2004). Specific to the context of a virtual environment, regular face-to-face meetings play a key role in team communication, including providing shared meaning and social context (Weimann, Hinz, Scott, & Pollock, 2010). Face-to-face meetings are even more important during the early stages of a virtual team. These interactions are critical as team members bond and get to know each other (Kirkman et al., 2004).

According to Rosen, Furst, and Blackburn (2006), “Initial face-to-face team-building sessions can overcome communication barriers, dispel stereotypes and help virtual team members develop more accurate impressions of their colleagues’ trustworthiness based on observation and conversation” (p. 231).

Individual and team tenure

Early on in its use, many virtual teams had a short life-cycle. That is, they were formed to solve a specific challenge and, once the task was complete, the teams were disbanded. Currently, many virtual teams have a continuous life-cycle. In fact, they are more appropriately characterized as permanent teams with virtual members. Research indicates that time has a positive impact on team functions and outcomes. This is important at the individual level, characterizing how long has a person has
been a part of the team, and at the team level, characterizing how long a team has been in existence. Teams benefit from members having familiarity with each other and having well-established relationships (Kozlowski, Gully, Nason, & Smith, 1999). Team performance is positively influenced when team members are familiar with each other and role networks established. (Bell & Kozlowski, 2002).

While this is true in all teams, research indicates that there is a positive influence in virtual environments, helping teams overcome some of their unique challenges. According to Hertel et al. (2005) and Ortiz de Guinea et al. (2012), distributed teams face numerous difficulties early on—once there is period of interaction and cooperation between members, many of these challenges disappear. In their meta-analysis of research on virtuality, Ortiz de Guinea et al. (2012) investigated the amount of time teams worked together as a moderator. The authors’ rationale was that longer-term teams were more common in most of today’s organizations. They also argued that team processes and commitment change over time. As teams develop more fully, variances tend to fade between face-to-face and virtual teams. The results of their analysis indicated that the virtuality did not have a negative effect on team performance and satisfaction in longer-term virtual teams:

For longer term teams, members would also be less likely to make misattributions to the person: as team members interact, they build knowledge of the underlying context and the parties involved in the communication grows, the ability for understanding and the richness of the message also grows. Similarly, as people start to identify with a team and build a team identity and psychological and affective ties to
the team, this helps overcome other sources of differences. (Ortiz de Guinea et al., 2012, p. 307)

Additional research found that long-term, stable relationships in virtual teams had a positive impact on team performance outcomes (Foster et al., 2015; Siebdrat, Hoegl, & Ernst, 2008).

**Training**

Even with the rapidly expanding use of virtual teams in all types of organizations, the amount and types of training provided is still limited. The 2016 survey conducted by Culture Wizard found that only 22% of the survey respondents participated in training to improve their productivity while working on a virtual team. To understand what type of training would be beneficial to those individuals working in a virtual environment, Rosen et al. (2006) surveyed 440 learning professionals and captured current practices in virtual team training. The authors identified several virtual team training areas, which are outlined in Table 6. The training topics are geared towards leaders as well as individual team members.
Table 6. Virtual Team Training Areas

<table>
<thead>
<tr>
<th>Training Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training on how to lead a virtual team meeting</td>
</tr>
<tr>
<td>Leader training on how to coach and mentor team members virtually</td>
</tr>
<tr>
<td>Training on how to monitor team progress, diagnose problems, and act</td>
</tr>
<tr>
<td>Training to use communication technologies</td>
</tr>
<tr>
<td>Training on how to establish trust and resolve conflict in virtual teams</td>
</tr>
<tr>
<td>Team-building new virtual teams</td>
</tr>
<tr>
<td>Using the appropriate technology to fit the task</td>
</tr>
<tr>
<td>How to recognize and reward individual contributions in a virtual environment</td>
</tr>
<tr>
<td>Training on how to select virtual team members</td>
</tr>
<tr>
<td>Understanding virtual team challenges</td>
</tr>
</tbody>
</table>

*Source:* Adopted from Rosen et al., 2006

In a study conducted by Cornelius and Boos (2003), the authors found that technology based communications had a negative impact on team performance. They also found that the best performance outcomes came from groups who received significant training on communicating through the use of electronic media. Based on their review of empirical research on managing virtual teams, Hertel et al. (2005) called training advisable. They indicated that training should include normal concepts applicable to all teams, such as roles and responsibilities and goal setting; however, training should also include topics targeted to working in a virtual environment, such as communicating with electronic media. Ford et al. (2016) indicated that team leaders should receive specific training in team building, collaboration, and leadership.
in a virtual environment. They also identified specific areas, such as the technical aspects of communication as well as recognizing signs of team member withdrawal and isolation.

**Individual Outcomes Used in this Dissertation**

**Satisfaction**

One outcome frequently referenced within the virtual team literature is job satisfaction. In general, results have indicated that higher levels of virtuality lead to lower levels of satisfaction. Lojeski and Reilly (2008) found that there was significant reduction in work satisfaction as virtual distance increased. Schweitzer and Duxbury (2010) conducted a study on virtual teams within the technology sector. They surveyed 108 individuals representing 31 different virtual teams. They found that member satisfaction was negatively associated with higher degrees of virtuality. Attempting to understand why this is the case, Ortiz de Guinea et al. (2012) conducted a meta-analysis of research on virtuality, and they found the following:

> In virtual settings, relationships take longer to develop. Stronger interpersonal relationships and team ties have been linked to motivation and less process loss, which in turn affects team satisfaction. More developed teams communicate more constructively, have more mutual understanding and knowledge, are able manage conflict more effectively, and are more cohesive. Therefore, virtual teams may have lower satisfaction, at least in the short-term. (p. 303)

Ultimately, their analysis indicated that the level of virtuality was negatively related to individual satisfaction. However, the authors noted that the majority of research
studies captured virtuality as a dichotomous variable. As discussed earlier, this has been one of the limitations with much of the past research efforts.

There are contradictory findings within the literature as well. Virtuality may not always have a negative impact on satisfaction. In their study on how telework impacts job satisfaction, Fonner and Roloff (2010) found that teleworkers were more satisfied than employees in a traditional team environment. They found these results were due to the increased autonomy and flexibility within their work environment.

There is also research on strategies to increase the level of satisfaction within a virtual environment. Gilson et al. (2015) conducted review of virtual team studies and found that high levels of satisfaction can be obtained as long as there is effective management of mediating variables, such as conflict management, technological capabilities, and learning behaviors. Nurmi and Hinds (2016) found that job complexity and learning opportunities positively influence both job satisfaction and work engagement.

**Engagement**
In many organizations, employee engagement is one of the key individual outcomes frequently measured on an annual basis. According to the Gallup Organization (2004) individual engagement has been shown to impact a range of outcomes, including customer loyalty, growth, and profitability (as cited in Kular, Gatenby, Rees, Soane, & Truss, 2008). Gallup (2004) has also found through analyzing their own data that
highly engaged teams within the same company outperform teams with lower engagement scores (as cited in Kular et al., 2008). While more has been written regarding employee engagement from practitioners and consulting firms, such as Gallup (2004, as cited in Kular et al., 2008), there is agreement within the academic community that high employee engagement levels can be associated with positive outcomes (Saks, 2006). Even with the significant growth of virtual teams, little research has investigated how this change influences employee engagement (Kular et al., 2008).

Griffith, Nordbäck, Sawyer, and Rice (2015) agreed that engagement is a predictor of performance. They also articulated that there is even an increasing importance of engagement in today’s work environment:

> Past research indicates that work engagement is an important predictor of performance, either directly or by mediating behavior. The contemporary work environment, facilitated by increasingly pervasive technology, as noted earlier, can allow/require organizational members to work in flexible, such as spatially and temporally dispersed ways. In these work contexts, work engagement would seem to be an even more important predictor of performance, because of less direct supervision and more distanced interactions, requiring greater self-direction and motivation. (Griffith et al., 2015, p. 1831)

While the others do not use the term virtuality, they reference technology use, spatial and temporal dispersion, and more distanced interactions. These descriptors characterize the virtual workplace. Clearly, engagement is an important outcome to consider.
Summary
Within this chapter, I have outlined the key literature and research regarding virtual teams and virtuality. Virtual teams have been described using various dimensions, such as geography, time zones, and technology usage. I provided a detailed summary of the most common definitions of virtual teams. Building on the virtual team literature, I included an in-depth review of the multi-dimensional construct of virtuality. The next section in the chapter included literature to support each of the seven core dimensions that I have outlined in my characterization of virtuality. These dimensions include geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. Next, I reviewed the literature related to those items that may influence team outcomes, including the amount of time an individual has been a part of the team (individual tenure), the amount of time the team has been in existence (team tenure), the number of face-to-face team meetings, and the amount of training a team has received related to working in a virtual environment. Lastly, I included literature supporting the individual outcomes of satisfaction and engagement.

In the next chapter, I will outline my research methodology including my research purpose and primary questions. I also describe my main effect hypotheses, which investigate the direct relationship between virtuality and the individual outcomes of job satisfaction and engagement. I also include information on my moderating variables and additional hypotheses related to team face-to-face meetings, team
tenure, individual tenure, and training. The chapter includes definitions of each variable and a review of my survey instrument and scoring. The last part of the chapter includes a diagram outlining the relationships between each of the variables.
Chapter 3: Methodology

Introduction
The purpose of this chapter is to outline my research methodology. It includes an overview of my research purpose and primary research questions. Following this discussion, I outline my main effect hypotheses, looking at the direct relationship between virtuality and the individual outcomes of job satisfaction and engagement. I then describe additional hypotheses related to the moderating variables of team face-to-face meetings, team tenure, individual tenure, and training. Following this section, I define each of virtuality dimensions, moderating variables, and individual outcomes, including a review of the survey instrument questions and scoring. Lastly, I provide a sample model of the expected relationships between the virtuality dimensions, moderating variables, and individual outcomes.

Research Purpose
Differences within the operationalized definitions of virtuality make it difficult to measure and compare how virtual work arrangements can affect teams (Chudoba et al., 2005). The aim of this research is to address the lack of a clear definition and measure of team virtuality, taking into account the key attributes and dimensions used to describe virtual teams. For my purposes, a virtual team is defined as an interdependent group of geographically and/or time dispersed individuals working toward common goals through the use of communication technologies (Hertel et al., 2005; Powell et al., 2004). Team virtuality is defined by measuring the extent of each
of these seven dimensions: geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance.

Using empirical data, I will attempt to answer these primary research questions:

- To what extent is a team virtual?
- Does the level of team virtuality influence individual job satisfaction?
- Does the level of team virtuality influence individual engagement?

To address the first question, I will utilize a series of team and individual measures indicating the level of team virtuality. To answer the second and third questions, I will compare the virtuality levels against measures of individual job satisfaction and individual engagement, attempting to determine to what extent the level of team virtuality influences these outcomes. Additionally, I will explore how the variables of face-to-face interactions, team tenure, individual member tenure, and training mediate both satisfaction and engagement within a virtual environment.

**Main effect hypotheses**

**Satisfaction**

In a number of studies, researchers have found that higher levels of virtuality lead to lower levels of satisfaction. Lojeski and Reilly (2008) found that as virtual distance increased, there was significant reduction in work satisfaction. Schweitzer and Duxbury (2010) conducted a study on virtual teams within the technology sector.
They found that member satisfaction was negatively associated with higher degrees of virtuality. In their meta-analysis of research on virtuality, Ortiz de Guinea et al. (2012) found that the level of virtuality was negatively related to individual satisfaction. However, the authors noted that the majority of research studies captured virtuality as a dichotomous variable. As discussed earlier, this has been one of the limitations with much of the past research efforts. To fully understand the effects of virtuality on individual outcomes, I adopt a multidimensional approach. Virtuality not only represents the dimensions proposed in this study, but each dimension must also be viewed on a continuum. This approach is consistent with the trends within the field. That is, all teams fall on a continuum from fully virtual to fully face-to-face (Berry, 2011; Hertel et al., 2005; Peñarroja et al., 2013; Schweitzer & Duxbury, 2010). Therefore, I am hypothesizing the following:

**Hypothesis 1:** There is a negative relationship between virtuality and individual satisfaction. Specifically, as the level of team virtuality increases, the level of individual satisfaction decreases.

**Engagement**

In many organizations, employee engagement is one of key individual outcomes frequently measured by employee opinion surveys. According to the Gallup Organization (2004), individual engagement has shown to impact a range of outcomes, including customer loyalty, growth, and profitability (as cited in Kular et al., 2008). Based on their own data, Gallup (2004) concluded that highly engaged teams outperform teams with lower engagement within the same company (as cited in
Kular et al., 2008). Griffith et al. (2015) found that engagement is a predictor of performance. They also articulated that within the current virtual work environment, employee engagement is an even more important influence on team performance.

Thus far, little research has investigated how the increase in virtual work environments has influenced employee engagement (Kular et al., 2008). For this study, I am hypothesizing the following:

**Hypothesis 2:** There is a negative relationship between virtuality and individual engagement. Specifically, as the level team virtuality increases, the level of individual engagement decreases.

**Moderating hypotheses**

**Face-to-face meetings**

Within many virtual team environments, research has shown that teams with limited opportunities for face-to-face interactions may experience productivity losses and performance issues (Gibson & Cohen, 2003). Research has also shown that regular face-to-face meetings play a key role in team communications, including providing shared meaning and social context (Weimann et al., 2010). Additional positive outcomes include the enablement of relationship development and mutual understanding (Dixon & Panteli, 2010), as well as building trust and performance improvement (Furst et al., 2004). Research has demonstrated that the amount of face-to-face interactions can influence individual outcomes within a virtual setting; therefore, I am hypothesizing the following:
**Hypothesis 3:** The number of face-to-face meetings moderates the relationship between virtuality and individual satisfaction. More specifically, the number of face-to-face meetings positively influences individual satisfaction in a virtual environment.

**Hypothesis 4:** The number of face-to-face meetings moderates the relationship between virtuality and individual engagement. More specifically, the number of face-to-face meetings positively influences individual satisfaction in a virtual environment.

**Team and individual tenure**

Early on, many virtual teams had a short life-cycle. That is, they were formed to solve a specific challenge and, once the task was complete, the teams were disbanded. Currently, many virtual teams have a continuous life-cycle. In fact, they are more appropriately characterized as permanent teams with virtual members. Ortiz de Guinea et al. (2012) investigated the amount of time teams worked together as a moderator. The authors’ contended that permanent virtual teams were the norm in many organizations. Additionally, they felt that team interactions and commitments evolve over time. Differences between face-to-face and virtual teams tend to fade over time. Similarly, Hertel et al. (2005) and Ortiz de Guinea et al. (2012) found that distributed teams experienced challenges early in their life-cycle; however, once team members have an opportunity to interact and cooperate, many of these challenges disappear. Teams benefit from members having familiarity with each other and having well-established relationships (Kozlowski et al., 1999). Specific to virtual team performance, Foster et al. (2015) found that longer-term relationships could
have a positive impact on performance outcomes. The amount of tenure for both the individual and team can influence the individual outcomes within a virtual setting; therefore, I am hypothesizing the following:

**Hypothesis 5:** The amount of time a team has been in existence (team tenure) moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of time a team has been in existence will positively influence individual job satisfaction in a virtual environment.

**Hypothesis 6:** The amount of time a team has been in existence (team tenure) moderates the relationship between virtuality and individual engagement. Specifically, the amount of time a team has been in existence (team tenure) will positively influence individual engagement in a virtual environment.

**Hypothesis 7:** The amount of time an individual (individual tenure) has been a part of their current team moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of time an individual has been a part of their current team will positively influence individual satisfaction in a virtual environment.

**Hypothesis 8:** The amount of time an individual (individual tenure) has been a part of their current team moderates the relationship between virtuality and individual engagement. Specifically, the amount of time an individual has been a part of their current team will positively influence individual engagement in a virtual environment.

**Training**
In a study conducted by Cornelius and Boos (2003), the authors found that the best performance outcomes in a virtual environment came from groups who received significant training on methods of communicating through the use of electronic
Even with the rapidly expanding use of virtual teams in all types of organizations, the amount and types of training provided is still limited. Rosen et al. (2006) concluded that training programs to facilitate effective virtual teams are very much still in their infancy. Not much has changed in the past decade. In the 2016 survey conduct by CultureWizard, the authors found that only 22% of their survey respondents participated in training to improve their productivity while working on a virtual team. The amount of training can influence individual outcomes within a virtual setting; therefore, I am hypothesizing the following:

**Hypothesis 9:** The amount of training an individual has received related to working in a virtual environment moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of training an individual has received related to working in a virtual environment will positively influence individual job satisfaction in a virtual environment.

**Hypothesis 10:** The amount of training an individual has received related to working in a virtual environment moderates the relationship between virtuality and individual engagement. Specifically, the amount of training an individual has received related to working in a virtual environment will positively influence individual engagement in a virtual environment.

**Research Methods**

In order to answer these research questions, I developed a survey instrument to measure team virtuality, satisfaction, engagement, and the four moderating variables of face-to-face meetings, individual tenure, team tenure, and training. The survey was administered to a sample of 150 individuals on multiple teams in a large,
multinational financial services company. The teams include a range of configurations on a continuum from fully face-to-face to completely virtual. The survey instrument is designed so that all teams generate a virtuality index score. Traditional, face-to-face environments would be on the lowest end of the continuum, and purely virtual teams would be on the highest end.

**Virtuality dimensions and measurement**
The survey includes items that measure the seven dimensions that capture team virtuality: geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. The initial survey question asked participants to list each member of his/her team. Further questions explored each of the dimensions for each person on the team.

**Measuring geographic dispersion**
As indicated earlier, geographic dispersion is the physical distance between individuals. In the survey instrument, I measured geographic dispersion using the scale created by Schweitzer and Duxbury (2010), which determined geographic dispersion score based on the time it would take to travel and meet face-to-face. Participants were asked to respond to the following question: *How would you describe the distance between the place where this team member does most of his/her work and the place where you do most of your work?* Answers were selected from the options listed in Table 7, and the corresponding scores were recorded. For this question, a score of 1 indicates the largest physical distance and a score of 0 indicates no physical distance, meaning work is performed from the same location.
Table 7. Geographic Dispersion Scoring

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same location</td>
<td>0</td>
</tr>
<tr>
<td>Different floor, same building</td>
<td>.2</td>
</tr>
<tr>
<td>Different building, same complex</td>
<td>.4</td>
</tr>
<tr>
<td>Different location, same metropolitan area</td>
<td>.6</td>
</tr>
<tr>
<td>Different area, same state</td>
<td>.8</td>
</tr>
<tr>
<td>Different state</td>
<td>1</td>
</tr>
<tr>
<td>Different country</td>
<td>1</td>
</tr>
</tbody>
</table>

To calculate the team measure of geographic dispersion, individual responses for each person on the team were averaged to come up with a composite geographic dispersion score.

Measuring temporal dispersion
Temporal dispersion investigates the extent in which team member work hours overlap. In the survey instrument, I measured this dimension by capturing the total number of time zones represented on the team. The answer choices were based on the initial survey being administered to a U.S. based audience. Participants were asked the following question: *Please select each time zone represented on your team.*

Answer choices included the following: *Eastern Time Zone, Central Time Zone, Mountain Time Zone, Pacific Time Zone, and Outside the Continental U.S.* A score of 1 indicated the highest possible number of time zones and the least amount of work
hour overlap between team members. A score of 0 indicated a single time zone, with all team members sharing the same work hours. Scoring for this item is summarized in Table 8.

Table 8. Temporal Dispersion Scoring

<table>
<thead>
<tr>
<th>Number of Time Zones</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>.75</td>
</tr>
<tr>
<td>3</td>
<td>.5</td>
</tr>
<tr>
<td>2</td>
<td>.25</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Measuring isolation
In this dissertation, isolation is defined as the amount of time spent working alone without the opportunity for face-to-face interactions with any other member of the team. I measured this dimension by capturing the number of days each week an individual works in a location separated from any other team member. By design, this item accounted for those employees who permanently work in this type of environment as well as employees who occasionally work from home or in a separate location. The survey instrument asked the following question: *To the best of my knowledge, how many days a week does this team member work in a location physically separate from any other team member?* Scoring for this item is summarized in Table 9. A score of 1 indicates that an individual is fully virtual,
meaning he or she works in a location physically separate from any other team member five days a week. A score of 0 indicates that an individual does not work any days a week in a location physically separate from any other team member; in other words, they work in a location with other team members every day of the week. To calculate the team measure of isolation, individual responses for each person on the team were averaged to come up with a composite score.

Table 9. Isolation Scoring

<table>
<thead>
<tr>
<th>Number of Days a Week Separate from Other Team Members</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>.8</td>
</tr>
<tr>
<td>3</td>
<td>.6</td>
</tr>
<tr>
<td>2</td>
<td>.4</td>
</tr>
<tr>
<td>1</td>
<td>.2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Measuring imbalance

Related to the dimension of isolation, imbalance considers the number of team members at any given location. As outlined in Table 5, there are 21 possible site configurations for an 8-member team. In this dissertation, imbalance is defined as the number of team members at each physical location represented by the team. I measure this dimension by asking survey participants the following question: What is
the number of different office locations for your team, and how many team members are based in each location? Scoring for this item is based on the average number of team members per location. The lowest score is 1, which represents a fully virtual team, with each location having only one person. Higher scores indicate more than one person at a location.

Measuring technological reliance
Technological reliance is defined as the amount of work accomplished through the use of communication technologies. This dimension is measured by capturing the total amount of work completed through the use of communication technologies. Survey participants were asked the following question: How much of your team’s work requires the use of communication technologies? Scoring for this item is summarized in Table 10. Scoring for this item was consistent with previous items in that lower scores represented less reliance on the use communication technologies and higher scores indicating more reliance on communication technologies. The rationale is that the need to rely on communication technologies for collaboration is higher in a virtual environment. In a traditional environment, communication and collaboration can be accomplished face-to-face.
Table 10. Technological Reliance Scoring

<table>
<thead>
<tr>
<th>Percentage of Work Requiring the Use of Communication Technologies</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>.2</td>
</tr>
<tr>
<td>40%</td>
<td>.4</td>
</tr>
<tr>
<td>60%</td>
<td>.6</td>
</tr>
<tr>
<td>80%</td>
<td>.8</td>
</tr>
<tr>
<td>100%</td>
<td>1</td>
</tr>
</tbody>
</table>

Measuring communication richness

Communication richness describes the quality of the communication based on Media Richness Theory, created by Daft and Lengel (1986). In order to measure communication richness, I utilized the method created by Ganesh and Gupta (2010). I rated the level of media richness for the various communication tools indicated in the study. Then I asked participants to indicate the frequency of usage for each tool. The scoring for media richness was based on the criteria developed by Daft and Lengel (1986), which included (1) the ability to allow for immediate feedback, (2) the number of cues, and (3) the level of focus on the individual. Scoring for communication richness is outlined in Table 11. The lowest score, or least virtual method of communication, is face-to-face communication. To calculate a communication richness score, I multiplied the frequency of use by the media richness rating. Table 12 summarizes the frequency of use scores. To calculate the
communication richness composite team score, I averaged the scores for each communication channel (see Figure 2 for an illustration of this calculation).

**Table 11. Media Richness Scoring**

<table>
<thead>
<tr>
<th>Communication Channel</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>0</td>
</tr>
<tr>
<td>Video conferencing</td>
<td>.15</td>
</tr>
<tr>
<td>Web conferencing</td>
<td>.3</td>
</tr>
<tr>
<td>Voice/phone</td>
<td>.45</td>
</tr>
<tr>
<td>Chat</td>
<td>.6</td>
</tr>
<tr>
<td>Email</td>
<td>.75</td>
</tr>
<tr>
<td>Text</td>
<td>.9</td>
</tr>
</tbody>
</table>

**Table 12. Frequency of Use Scoring**

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every day</td>
<td>1</td>
</tr>
<tr>
<td>A few times a week</td>
<td>.9</td>
</tr>
<tr>
<td>Weekly</td>
<td>.75</td>
</tr>
<tr>
<td>A few times a month</td>
<td>.60</td>
</tr>
<tr>
<td>Monthly</td>
<td>.45</td>
</tr>
<tr>
<td>Quarterly</td>
<td>.30</td>
</tr>
<tr>
<td>Once or twice a year</td>
<td>.15</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
</tr>
</tbody>
</table>
Figure 2. Communication Richness Composite Scoring

<table>
<thead>
<tr>
<th>Communication Channel</th>
<th>Face-to-face</th>
<th>Video conferencing</th>
<th>Web conferencing</th>
<th>Voice/phone</th>
<th>Chat</th>
<th>Email</th>
<th>Text</th>
<th>Communication Richness Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Richness Factor</td>
<td>0</td>
<td>0.15</td>
<td>0.3</td>
<td>0.45</td>
<td>0.6</td>
<td>0.75</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Frequency of Use</td>
<td>Monthly</td>
<td>Quarterly</td>
<td>A few times a week</td>
<td>A few times a week</td>
<td>Every day</td>
<td>Every day</td>
<td>Weekly</td>
<td></td>
</tr>
<tr>
<td>Usage Factor</td>
<td>0.45</td>
<td>0.3</td>
<td>0.9</td>
<td>0.9</td>
<td>1</td>
<td>1</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>C.R. Factor × Usage Factor</td>
<td>0</td>
<td>0.045</td>
<td>0.27</td>
<td>0.405</td>
<td>0.6</td>
<td>0.75</td>
<td>0.675</td>
<td>0.39</td>
</tr>
</tbody>
</table>

Measuring leader distance
Leader distance is defined as the physical distance between the leader and each individual on the team. In the survey instrument, I measured leader distance using the scale created by Schweitzer and Duxbury (2010), which is the same scale used for geographic dispersion, based on the time it would take to travel and meet face-to-face. Participants were asked to respond to the following question: How would you describe the distance between the place where your team leader does most of his/her work and the place where this team member does most of his/her work? Answers were selected from the options listed in Table 13, and the corresponding scores were recorded. For this question, a score of 1 indicates the largest physical distance and a score of 0 indicates no physical distance, meaning work is performed from the same location. Individual team member scores were averaged to determine a composite team leader distance score.
Table 13. Leader Distance Scoring

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same location</td>
<td>0</td>
</tr>
<tr>
<td>Different floor, same building</td>
<td>.2</td>
</tr>
<tr>
<td>Different building, same complex</td>
<td>.4</td>
</tr>
<tr>
<td>Different location, same metropolitan area</td>
<td>.6</td>
</tr>
<tr>
<td>Different area, same state</td>
<td>.8</td>
</tr>
<tr>
<td>Different state</td>
<td>1</td>
</tr>
<tr>
<td>Different country</td>
<td>1</td>
</tr>
</tbody>
</table>

**Moderating variables**
The main effect hypotheses investigated the direct relationship of the level of virtuality with the individual outcomes of job satisfaction and engagement. The survey instrument included additional items investigating the moderating variables of team face-to-face meetings, team tenure, individual tenure, and training.

**Measuring team face-to-face meetings**
Team face-to-face meetings are defined as opportunities for the entire team to interact in a traditional, face-to-face setting. In the survey instrument, participants were asked to respond to the following question: *How often does your primary team meet in a face-to-face setting?* Answer choices and corresponding scores are included in Table 14. Directionally higher scores indicate increased face-to-face meetings, and lower scores indicate less or even no face-to-face meetings, meaning a team is fully virtual.
Table 14. Team Face-to-Face Meeting Scoring

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every day</td>
<td>8</td>
</tr>
<tr>
<td>A few times a week</td>
<td>7</td>
</tr>
<tr>
<td>Weekly</td>
<td>6</td>
</tr>
<tr>
<td>A few times a month</td>
<td>5</td>
</tr>
<tr>
<td>Monthly</td>
<td>4</td>
</tr>
<tr>
<td>Quarterly</td>
<td>3</td>
</tr>
<tr>
<td>Once or twice a year</td>
<td>2</td>
</tr>
<tr>
<td>Never</td>
<td>1</td>
</tr>
</tbody>
</table>

Measuring team tenure
Team tenure is defined as the amount of time a team has been in existence. In the survey instrument participants were asked the following questions: How long has your team been in existence? Participant responses and scoring are captured in Table 15. Given research has indicated that longer-term relationships positively impact virtual team performance (Foster et al., 2015), and the impact of a high level of virtuality is greatest early on in the life of a team. Directionally, the longer the team tenure, the higher the score.
Table 15. Team Tenure Responses and Scoring

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3 months</td>
<td>1</td>
</tr>
<tr>
<td>3–6 months</td>
<td>2</td>
</tr>
<tr>
<td>6–12 months</td>
<td>3</td>
</tr>
<tr>
<td>1–2 years</td>
<td>4</td>
</tr>
<tr>
<td>More than 2 years</td>
<td>5</td>
</tr>
</tbody>
</table>

Measuring individual tenure
Individual tenure is defined as the amount of time an individual has been a part of a team. In the survey instrument participants were asked the following questions: *How long has this person been a member of the team?* Participant responses and scoring are the same as for team tenure (see Table 15). Individual tenure scores for each team were averaged to calculate a composite individual tenure score.

Measuring training
Training is defined as targeted, formal instruction geared toward successful performance in a virtual team setting. In the survey instrument, participants were asked the following question: *During the past year, what is the amount of training your team has received related to working in a virtual environment?* Participant responses and scoring are listed in Table 16. For this item, scoring was reflected with the lower scores indicating less training and the higher scores indicating more training.
Table 16. Team Training Responses and Scoring

<table>
<thead>
<tr>
<th>Amount of Training in Past Year</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>1 hour or less</td>
<td>2</td>
</tr>
<tr>
<td>1–4 hours</td>
<td>3</td>
</tr>
<tr>
<td>1 day</td>
<td>4</td>
</tr>
<tr>
<td>More than 1 day</td>
<td>5</td>
</tr>
</tbody>
</table>

Individual outcomes

Job satisfaction
In order to measure satisfaction, I utilized the Michigan Organizational Assessment Questionnaire Job Satisfaction Subscale (MOAQ-JSS). One of the biggest advantages of this instrument is its length. The MOAQ-JSS includes only three items. Given concerns about the overall survey length, this was ideal. Scores on the MOAQ-JSS are comprised using an average of the three items listed below (Bowling & Hammond, 2008):

- All in all I am satisfied with my job.
- In general, I don’t like my job.
- In general, I like working here.

The use of a measure of job satisfaction allows me to compare the level of team virtuality with individual job satisfaction in order to understand whether or not virtuality has an impact on individual job satisfaction.
Engagement
Engagement will be measured using the shortened, 9-item version of the Utrecht Work Engagement Scale (UWES-9). The factorial validity of the 9-item version was demonstrated by Schaufeli, Bakker, and Salanova (2006). The items, measured on a seven-point scale, include the following:

- At my work, I feel bursting with energy.
- At my job, I feel strong and vigorous.
- I am enthusiastic about my job.
- My job inspires me.
- When I get up in the morning, I feel like going to work.
- I feel happy when I am working intensely.
- I am proud of the work that I do.
- I am immersed in my job.
- I get carried away when I am working.

The use of a measure of engagement allows me to compare the level of team virtuality with individual engagement to understand the relationship.

Sample model
My research explores the relationships outlined in Figure 3. First, I looked at the seven individual dimensions comprising of my definition of team virtuality. Statistically, I investigated whether or not these variables were linked into an overall dimension or virtuality index. In other words, did the team scores for each of the seven items combine into one overall composite score, which I am calling a Team
Virtuality Index, or TVI. Ultimately, I did create a TVI based on five of the dimensions. Next, I looked at the relationships between the TVI and the individual outcomes of job satisfaction and engagement. Then I investigated how the moderating variables of team tenure, member tenure, face-to-face meetings, and training influenced the relationship between the level of virtuality and the outcomes of engagement and satisfaction.

**Figure 3. Team Virtuality & Satisfaction and Engagement**

![Diagram showing relationships between team virtuality and satisfaction, engagement, tenure, and other variables.]

**Summary**

This chapter provided an overview of my research methodology. I reviewed my research aim to address the lack of definition and measurement regarding team virtuality. I reviewed my primary research questions, which included understanding
the extent to which a team is virtual and how this level of virtuality influences team outcomes. I outlined my main effect hypotheses, looking at the direct relationship between virtuality and the individual outcomes of job satisfaction and engagement. I then described additional hypotheses related to the moderating variables of team face-to-face meetings, team tenure, individual tenure, and training. I defined each of virtuality dimensions, moderating variables, and individual outcomes. I also reviewed the survey instrument questions and scoring methodology. In the last section, I included a sample model of the expected relationships between the virtuality dimensions, moderating variables, and individual outcomes.
Chapter 4: Results

Introduction
This chapter summarizes the results of my data analysis. I begin by providing an overview of descriptive statistics of the sample population, including information on the sample size, gender, age, and ethnicity of the participants. I then summarize the findings related to the measure of team virtuality. After testing multiple combinations of dimensions, ultimately a five-item measure was selected as the best fit to capture the extent of team virtuality: geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance. I then provide a summary of the results for each of the hypothesis. This includes the main effect hypotheses, which explore the relationship between team virtuality and job satisfaction and engagement, as well as the moderating hypotheses, which explore the influence of team and individual tenure, team face-to-face meetings, and training.

Descriptive Statistics
This section of the chapter outlines the description statistics of the sample population. As noted earlier, the survey was administered to a sample of 150 individuals on multiple teams in a large financial services company. The survey was completed by 103 participants; however, 15 responses were eliminated from the analysis due to missing information.
Gender
There was no attempt to control for gender within the survey population. Out of those individuals who completed the survey, 61.4% (n=54) were female and 37.5% (n=33) were male; one individual preferred not to answer.

Age
There was a range in age of survey participants from 25–64 with the highest percentage of participants in the 45–54 range. Table 17 outlines the percentage and number of respondents in each of the age range categories.

Table 17. Age of Survey Respondents

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 to 34</td>
<td>10</td>
<td>11.4</td>
<td>11.4</td>
<td>11.4</td>
</tr>
<tr>
<td>35 to 44</td>
<td>12</td>
<td>13.6</td>
<td>13.6</td>
<td>25.0</td>
</tr>
<tr>
<td>45 to 54</td>
<td>40</td>
<td>45.5</td>
<td>45.5</td>
<td>70.5</td>
</tr>
<tr>
<td>55 to 64</td>
<td>23</td>
<td>26.1</td>
<td>26.1</td>
<td>96.6</td>
</tr>
<tr>
<td>65 to 74</td>
<td>3</td>
<td>3.4</td>
<td>3.4</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Race/Ethnicity
Table 18 outlines the race/ethnicity breakdown of the survey respondents.

Table 18. Race/Ethnicity of Survey Respondents

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>Asian</td>
<td>2</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Black/African-American</td>
<td>6</td>
<td>6.8</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Hispanic/Latino</td>
<td>3</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Prefer not to answer</td>
<td>3</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>74</td>
<td>84.1</td>
<td>84.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>88</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Team size
Participants in the survey had team sizes ranging from 3 to 10 individuals, with most participants being on teams ranging from 5 to 8 people. Table 19 outlines the overall breakdown of the number of survey response for each size of team.
Table 19. Team Size

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>3</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>17.0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>15.9</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>13.6</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Results**

This section provides a summary of the analysis utilized to determine the final dimensions included in the measure of team virtuality. Multiple models incorporating different dimensions were investigated and tested. The virtuality measure results are then compared to the individual outcomes of job satisfaction and engagement.

Following the explanation of these results, this section provides a summary of the analysis related to each hypothesis.

**Measuring virtuality**

As previously discussed, differences within the literature regarding the operationalized definitions of virtuality make it challenging to measure and compare
how virtual work environments can influence team outcomes (Chudoba et al., 2005).

One of the primary aims of this research is to address the lack of a clear definition and measure of team virtuality. Building upon prior research and the existing literature, this study investigates the key attributes and dimensions used to describe virtual teams. These dimensions include geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance.

Using these seven dimensions as a theoretical foundation, a tentative measure of virtuality was created assessing all seven items. The method for capturing and scoring each of the dimensions on the questionnaire is outlined in the methods section. Additionally, the questionnaire is included in Appendix A. Table 20 displays the means, standard deviations, and ranges for the original set of items within the virtuality measure.
In order to test the internal consistency of the seven dimensions, a Cronbach’s alpha was performed. A Cronbach’s alpha is a measure of internal consistency, examining how closely related are a set of items as a group (Tavakol & Dennick, 2011). Scores are calculated from 0 to 1, and higher scores are more acceptable. The general rule is that 0.7 or above is a reasonable level for acceptable outcomes.

The initial reliability analysis performed to validate the original 7-item virtuality measure produced an unacceptable Cronbach’s alpha of .56. This indicated that it was inappropriate to combine the seven items into a single composite score. Additional analysis was performed with a 6-item virtuality measure, which also produced an unacceptable Cronbach’s alpha of .58. Further examination of the data revealed that a 5-item measure of virtuality produced a Cronbach’s alpha of .81, indicating good internal reliability. The five dimensions included in this measure were geographic
dispersion, temporal dispersion, isolation, technological reliance, and leader distance. Communication richness and imbalance were the two items not included in this measure. The scoring for each of the five items was averaged to produce a team virtuality score for each respondent. This measure ranged from .08 (low virtuality) to .92 (high virtuality) in this sample. The mean = .64 with a standard deviation of .19. Figure 4 displays the distribution of this measure within this sample. It suggests that the variable was fairly normally distributed within the sample.

Figure 4. 5-Item Measure of Team Virtuality

As an initial check on the face validity of the 5-item measure, the bivariate correlation between the virtuality measure, and the number of face-to-face meetings was
analyzed. The rationale was that virtual teams, by definition, are less likely to have face-to-face meetings. Results revealed that the two variables correlated at \( r = -.68 \), which indicates a strong negative association (\( p. = .00 \)). This provides some initial validation of the 5-item virtuality measure.

**Test of hypotheses**

**Main effect hypotheses**
The initial hypotheses outlined the relationship between the measure of team virtuality and the outcomes of individual job satisfaction and individual engagement. The first hypothesis focused on the relationship between virtuality and individual team member job satisfaction:

**Hypothesis 1:** There is a negative relationship between virtuality and individual satisfaction. Specifically, as the level of team virtuality increases, the level of individual satisfaction decreases.

This notion was tested via the bivariate correlation between virtuality and satisfaction. *The hypothesis was not supported.* The correlation between the variables was \( r = .03 \), \( p. = .40 \).

The second hypothesis centered on the relationship between virtuality and the outcome of individual engagement:

**Hypothesis 2:** There is a negative relationship between virtuality and individual engagement. Specifically, as the level team virtuality increases, the level of individual engagement decreases.
This prediction was also tested via a calculation of the bivariate correlation. The correlation was $r = -0.15$, indicating a negative association in the expected direction. However, the $r$ value did not meet conventional levels of statistical significance ($p = .09$). *Thus, hypothesis 2 was not supported.*

**Moderating hypotheses**
The hypotheses predicting moderating effects were explored via a multiple regression procedure outlined by Cohen, Cohen, West, and Aiken (2003). This procedure entails entering the variables representing the main effects on the first step of the regression and then entering an interaction term (computed by multiplying the main effects together) on the second step.

**Face-to-face meetings**
The third hypothesis investigated the impact of team face-to-face meetings in a virtual environment, looking at the frequency of meetings and change in individual job satisfaction:

**Hypothesis 3:** The number of face-to-face meetings moderates the relationship between virtuality and individual satisfaction. More specifically, the number of face-to-face meetings positively influences individual satisfaction in a virtual environment.

This prediction was tested by entering the virtuality measure and the measure of face-to-face meetings on the first step of the regression and the interaction term on the
second step. *This hypothesis was not supported.* Table 21 displays the regression results. The final model produced a nonsignificant $F$ (84,3) value of .62 ($p = .30$).

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beta</strong></td>
<td><strong>Significance of $t$</strong></td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.11</td>
</tr>
<tr>
<td>Face-to-Face Meetings</td>
<td>-.20</td>
</tr>
<tr>
<td>Virtuality x Face-to-Face Meetings</td>
<td></td>
</tr>
</tbody>
</table>

| $R^2$ | .02 |
| $F$ for change $R^2$ | .94 |

Dependent Variable: Satisfaction

The fourth hypothesis investigated the impact of team face-to-face meetings in a virtual environment, looking at the frequency of meetings and change in individual engagement:

**Hypothesis 4:** The number of face-to-face meetings moderates the relationship between virtuality and individual engagement. More specifically, the number of face-to-face meetings positively influences individual engagement in a virtual environment.
The final regression equation (with all variables entered) produced an $F$ (3, 83) of 2.24, $p. = .02$. Examination of the Beta coefficients revealed that the interaction term was the only significant variable in the final equation (see Table 22). While the result was statistically significant, the variable negatively influenced engagement; therefore the hypothesis was not supported.

**Table 22. Face-to-Face Meetings and Engagement**

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th></th>
<th></th>
<th>Step 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>$t$</td>
<td>Significance of $t$</td>
<td>Beta</td>
<td>$t$</td>
<td>Significance of $t$</td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.19</td>
<td>-1.22</td>
<td>.11</td>
<td>.25</td>
<td>.98</td>
<td>.16</td>
</tr>
<tr>
<td>Face-to-Face Meetings</td>
<td>-.07</td>
<td>-.43</td>
<td>.33</td>
<td>.26</td>
<td>1.22</td>
<td>.11</td>
</tr>
<tr>
<td>Virtuality x Face-to-Face Meetings</td>
<td>-.38*</td>
<td>-2.20</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R$^2$ .02

$F$ for change R$^2$ .94

Dependent Variable: Engagement *$p. < .05$

Team tenure

Team tenure characterizes the length of time a team has been in existence. Two hypotheses explored the interaction effects of virtuality and team tenure. Hypothesis
five outlined the expected relationship between team tenure and individual job satisfaction within a virtual team environment:

**Hypothesis 5:** The amount of time a team has been in existence (team tenure) moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of time a team has been in existence will positively influence individual job satisfaction in a virtual environment.

*This hypothesis is not supported.* The final regression equation (with all variables entered) produced an overall $F(3, 83)$ of .22, $p. = .45$. Table 23 outlines the details of the regression analysis.

**Table 23. Team Tenure and Satisfaction**

<table>
<thead>
<tr>
<th></th>
<th>Step 1 Beta</th>
<th>t</th>
<th>Significance of t</th>
<th>Step 2 Beta</th>
<th>t</th>
<th>Significance of t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtuality</td>
<td>.03</td>
<td>.22</td>
<td>.41</td>
<td>.32</td>
<td>.72</td>
<td>.24</td>
</tr>
<tr>
<td>Team Tenure</td>
<td>.03</td>
<td>.27</td>
<td>.40</td>
<td>.18</td>
<td>.73</td>
<td>.23</td>
</tr>
<tr>
<td>Virtuality x Team Tenure</td>
<td>-.38</td>
<td>-.69</td>
<td>.25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R$^2$ .00

$F$ for change R$^2$ .50

Dependent Variable: Satisfaction

Hypothesis six outlined the expected relationship between team tenure and individual engagement within a virtual team environment:
**Hypothesis 6:** The amount of time a team has been in existence (team tenure) moderates the relationship between virtuality and individual engagement. Specifically, the amount of time a team has been in existence (team tenure) will positively influence individual engagement in a virtual environment.

The final regression equation (with all variables entered) produced an overall $F (3, 83)$ of .89, $p = .22$. Thus, hypothesis 6 was not supported. Table 24 presents the details of the regression analysis.

**Table 24. Team Tenure and Engagement**

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th></th>
<th>Step 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>$t$</td>
<td>Significance of $t$</td>
<td>Beta</td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.11</td>
<td>-.97</td>
<td>.16</td>
<td>-.37</td>
</tr>
<tr>
<td>Team Tenure</td>
<td>-.09</td>
<td>-.74</td>
<td>.23</td>
<td>-.09</td>
</tr>
<tr>
<td>Virtuality x Team Tenure</td>
<td></td>
<td></td>
<td></td>
<td>.34</td>
</tr>
</tbody>
</table>

$R^2$                           | .03    |                  | .03    |                  |

$F$ for change $R^2$            | 1.13   |                  | .38    |                  |

Dependent Variable: Engagement

Individual tenure

While team tenure explored the length of time a team has been in existence, individual tenure characterizes the amount of time and individual has been a member of a team. Two hypotheses examined possible interaction effects of individual tenure
on individual job satisfaction and individual engagement. The seventh hypothesis focused on individual tenure and individual job satisfaction:

**Hypothesis 7:** The amount of time an individual (individual tenure) has been a part of their current team moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of time an individual has been a part of their current team will positively influence individual satisfaction in a virtual environment.

*This hypothesis was not supported.* The final regression equation (with all variables entered) produced an overall $F(3, 83)$ of 1.37, $p. = .13$. Table 25 outlines the details of the regression analysis. Examination of the individual coefficients reveals a possible main effect for individual tenure on satisfaction. However, conventional methods caution against interpreting individual coefficients when the overall equation is not significant.

**Table 25. Individual Tenure and Satisfaction**

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th></th>
<th>Step 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>$t$</td>
<td>Significance of $t$</td>
<td>Beta</td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.06</td>
<td>-.50</td>
<td>.30</td>
<td>-.12</td>
</tr>
<tr>
<td>Individual Tenure</td>
<td>.23</td>
<td>2.00*</td>
<td>.05</td>
<td>.21</td>
</tr>
<tr>
<td>Virtuality x Individual</td>
<td>.08</td>
<td></td>
<td></td>
<td>.08</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.05</td>
<td></td>
<td></td>
<td>.05</td>
</tr>
<tr>
<td>$F$ for change $R^2$</td>
<td>2.07**</td>
<td></td>
<td></td>
<td>.02</td>
</tr>
</tbody>
</table>

Dependent Variable: Satisfaction; *$p. < .05$; **$p. = .07$
Hypothesis 8 focused on the possible effects of individual tenure on individual engagement:

**Hypothesis 8:** The amount of time an individual (individual tenure) has been a part of their current team moderates the relationship between virtuality and individual engagement. Specifically, the amount of time an individual has been a part of their current team will positively influence individual engagement in a virtual environment.

*This hypothesis was not supported.* The final regression equation (with all variables entered) produced an overall $F (3, 83)$ of .94, $p = .22$. Table 26 outlines the details of the regression analysis.

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Beta</strong></td>
<td><strong>$t$</strong></td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.09</td>
<td>-.77</td>
</tr>
<tr>
<td>Individual Tenure</td>
<td>-.12</td>
<td>-1.06</td>
</tr>
<tr>
<td>Virtuality x</td>
<td>.04</td>
<td>.48</td>
</tr>
<tr>
<td>Individual Tenure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent Variable:</td>
<td>Engagement</td>
<td></td>
</tr>
</tbody>
</table>

Table 26. Individual Tenure and Engagement
Training
The final two hypotheses explored the possible moderating effects of virtual team training. In this context, the training content is focused on working in a virtual environment. The ninth hypothesis centered on the amount of training received and the change in individual job satisfaction:

**Hypothesis 9:** The amount of training an individual has received related to working in a virtual environment moderates the relationship between virtuality and individual satisfaction. Specifically, the amount of training an individual has received related to working in a virtual environment will positively influence individual job satisfaction in a virtual environment.

*This hypothesis was not supported.* The final regression equation (with all variables entered) produced an overall $F (3, 83)$ of $.77, p. = .26$. Table 27 presents the details of the regression analysis.
Finally, the tenth hypothesis explored the amount of training received and the change in individual engagement:

**Hypothesis 10:** The amount of training an individual has received related to working in a virtual environment moderates the relationship between virtuality and individual engagement. Specifically, the amount of training an individual has received related to working in a virtual environment will positively influence individual engagement in a virtual environment.

*This hypothesis was not supported.* The final regression equation (with all variables entered) produced an overall $F (3, 83)$ of .77, $p = .26$. Table 28 outlines the details of the regression analysis.
Table 28. Training and Engagement

<table>
<thead>
<tr>
<th></th>
<th>Step 1</th>
<th></th>
<th>Step 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>$t$</td>
<td>Significance of $t$</td>
<td>Beta</td>
</tr>
<tr>
<td>Virtuality</td>
<td>-.13</td>
<td>-1.17</td>
<td>.12</td>
<td>-.09</td>
</tr>
<tr>
<td>Training</td>
<td>.08</td>
<td>-.72</td>
<td>.23</td>
<td>.01</td>
</tr>
<tr>
<td>Virtuality x Training</td>
<td></td>
<td></td>
<td></td>
<td>-.10</td>
</tr>
</tbody>
</table>

$R^2$        .03          .03
$F$ for change $R^2$ 1.12        .05

Dependent Variable: Engagement

**Additional Analysis**

Given the results of the hypotheses, additional analysis was performed to understand the variance within main effect variables and moderating variables.

**Satisfaction and engagement**

Examination of the data suggests that the detection of any linear effects may have been hampered by ceiling effects seen on both the satisfaction and engagement variables. Results of this analysis are provided here; however, this will be explored further in the discussion section of this dissertation.

For satisfaction, the mean score was 6.03, and 42% of the sample (n=37) scored the maximum score of 7, and 76% (n=68) scored 6 or above on this 1–7 scale. Only 3
respondents (3%) scored below the scale midpoint of 3.50. Figure 5 is the scatterplot depicting the relationship between virtuality and satisfaction in this sample. In looking at the top part of the chart, the ceiling effect is illustrated with 76% of the plots being on or above 6.0.

**Figure 5. Satisfaction and Virtuality**

For engagement, the mean was 6.18, and a total of 40% of the sample (n=30) scored 6.44 or higher on the 1-7 scale of engagement, and only 2 respondents (2%) scored
below the scale midpoint of 3.50. The scatterplot in Figure 6 displays the relationship between the virtuality and engagement variables. Again, the chart reveals the ceiling effect for the engagement variable with 68% of the responses ($n = 59$) above 6.0 and 77% of the responses ($n = 77$) above 5.0.

Figure 6. Engagement and Virtuality
Individual and team tenure
For individual tenure, the mean score was 4.44 (on a 5-point scale) with 82% of respondents (n = 72) scoring 4.0 or higher, indicating that they have been a part of their primary team for more than 1 year. Additionally, 28% of the respondents (n = 25), scored 5.0, indicating that they have been on their team for more than 2 years.

For team tenure, the mean score was 4.59 with a range for teams being in existence for 3–6 months to over 2 years. A full 76% (n = 67) of the teams have been in existence for more than 2 years, and another 11% (n = 10) have been in existence between 1–2 years.

Within this sample, both the individual and team tenure results are indicating that people have significant experience working within a virtual environment and their teams have been operating this way for an extended period of time. This certainly supports the notion that virtual teams are becoming the norm in many organizations. Further implications of this will be explored in the discussion section of this dissertation.

Face-to-face meetings
For face-to-face meetings, 11% of the respondents (n = 10) reported that their teams never meet face-to-face. Another 61% (n = 54) indicated that their teams meet in a face-to-face setting once or twice a year. A total of 87% of the respondents (n = 77)
meet once a quarter or less. Given this high percentage, and given the high level of individual satisfaction and engagement scores within this sample, the lack of face-to-face meetings may not necessarily impede job outcomes. This will be explored further in the discussion section of this dissertation.

**Training**
The training results indicated that 48% of the respondents (n = 42) received no training related to working in a virtual environment. Another 19% (n = 17) received 1 hour or less of training, and 19% (n = 17) received 1–4 hours of training. These numbers indicate that 86% (n = 76) of the respondents received less than 4 hours of training related to working in a virtual environment. With almost half the respondents indicating they have received no training to help them navigate working in a virtual environment, this remains an area of opportunity for many organizations.

**Summary**
This chapter provided a summary of the results of this research. I outlined the analysis undertaken to determine the most appropriate measure of team virtuality. Ultimately, the five-item measure of virtuality was selected. The dimensions included in this measure were geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance. Communication richness and imbalance were the two dimensions that did not statistically tie into the measure. Based on this measure of team virtuality, I then outlined the results of the main effect hypothesis,
which explored the relationship between the level of team virtuality and the individual outcomes of engagement and satisfaction. Both hypotheses related to these outcomes were not supported. I then summarized the results of the hypotheses related to the moderating variables of individual and team tenure, team face-to-face meetings, and training. The hypotheses related to the moderating variables were not supported. The last section in the chapter provided additional results from analysis conducted on the variables to understand the variance and frequencies within the results.

The next chapter explores the implications of these findings. Additionally, I explore other findings within the data that did not directly relate to the hypotheses.
Chapter 5: Discussion

This chapter discusses the key contributions of this research. It starts with a review of the Team Virtuality Index (TVI) by outlining the five dimensions included in the model and the two dimensions not included from the original conceptual design. I then provide a review and explanation of the high satisfaction and engagement scores within this sample. Following that, I summarize and elaborate on the findings related to the moderating variables. This includes discussing the influence of tenure within a virtual environment for both individuals and at the team level. I also explore the importance of face-to-face meetings within high, medium, and low virtuality environments. I review the findings and opportunities related to virtual team training and discuss whether or not the construct of a traditional team—working in a completely face-to-face environment—is still valid. I include a discussion looking at the results from a group development perspective, where I argue that the groups within this study were likely operating at a higher stage of development, thus contributing to the high levels of satisfaction and engagement. Lastly, I summarize the limitations within this research.

**A New Measure of Team Virtuality**

Teams are no longer considered either virtual or traditional, and the construct of virtuality is a way to capture this new team attribute. Within the literature, there are numerous definitions and dimensions used to characterize virtuality. This dissertation
addresses the significant opportunity to advance the field by clearly defining and constructing a method to measure virtuality. The goal was to build upon the existing literature and create a more precise definition and systematic process for measuring to what extent a team is virtual. A Team Virtuality Index (TVI) was created, defined, and tested, and was ultimately refined to five dimensions: geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance.

**Dimensions included in the TVI**
Within the original conceptual model, seven dimensions were included in the definition of team virtuality. These dimensions included geographic dispersion, temporal dispersion, isolation, imbalance, technological reliance, communication richness, and leader distance. After analyzing statistical models including seven, six, five, and four dimensions, the five-dimensional model was the one that best captured team virtuality. The five dimensions, which represent the Team Virtuality Index (TVI), are geographic dispersion, temporal dispersion, isolation, technological reliance, and leader distance. The two dimensions that did not statistically align with the TVI were communication richness and imbalance.

The first dimension within the TVI is geographic dispersion. As previously stated, geographic dispersion is the dimension included in most characterizations of virtual teams. In this study, geographic dispersion was defined as the physical distance between individuals. Given the limitations on the opportunity for team members to communicate face-to-face, Fiol and O'Connor (2005) called geographic dispersion the
defining attribute of virtuality. Ferretti (2016) outlined spatial distribution as one of two “universally applicable measures” of team virtuality.

The second dimension within the TVI is temporal dispersion, which characterizes the number of time zones represented within the team. The implication of differing time zones is the amount of normal work hours that overlap providing opportunities for interaction, collaboration, and coordination. Arling and Subramani (2011) indicated that temporal dispersion is a critical consideration for virtual teams, as the number of workplace challenges increases with varying work hours.

The third dimension within the TVI is isolation. Earlier research by O'Leary and Cummings (2007) measured isolation by taking into account individuals located at work sites with no other team members. While this captured the extent of fully isolated members, it does not capture the nuance of today’s work environments, where teams have varying configurations, including regular work from home days. In this dissertation, isolation was characterized as the amount of time an individual spent working in an environment without the opportunity for face-to-face interactions with any other member of the team, whether this was one day a week or every day of the week.

The fourth dimension within the TVI is technological reliance. In this dissertation, technological reliance captured the amount of work that is accomplished through the
use of communication technologies. The results of this study found that 72% of all respondents in all types of teams indicated that they rely on technology for more than 80% of their work. Avolio and Kahai (2003) argued that in many organizations, the majority of interactions are conducted through the use of communication technologies. This is a clear indication of the changing dynamics of teams today and the heavy reliance of communication technologies in both traditional and virtual work environments. Later in this chapter, I outline additional analysis around this dimension, and I while I conclude that there is a high level of reliance in all types of environments, I still included technological reliance as a dimension within the TVI. I did this for a couple of key reasons. The first reason is that, beyond geographic dispersion, this dimension is the other one most frequently cited within the literature as a defining characteristic of virtuality. The second reason is that this dimension is closely related to another dimension, which is communication richness. While technological reliance captures the amount of reliance on communication technologies, communication richness attempts to measure the quality of these communications. As described later in this chapter, this is an area for further exploration.

The last dimension within the TVI is leader distance. In this dissertation, leader distance was defined as the physical distance between each team member and the formal team leader. While prior research examined outcomes such as leadership
effectiveness as the level of team virtuality increased, no prior research captured leader distance as a dimension of virtuality.

**Contribution—Virtuality measure**

Collectively, these five dimensions capture the level of team virtuality, which I am calling the Team Virtuality Index (TVI). One of the primary contributions of this research is that it provides a multidimensional and measurable model of team virtuality, which addresses the critical differences in team environments. As outlined in the literature review section, very little prior research has attempted to clearly define and measure virtuality (Schweitzer & Duxbury, 2010). Many researchers have characterized this as a critical need in order to advance the study of virtual teams within organizations (Gilson et al., 2015; Hosseini, Zuo, et al., 2015). While there has been agreement that virtuality is a multidimensional construct, consistent definitions and empirical research has been lacking (Gibson et al., 2014).

This research directly addresses this need. This model represents a clear definition of team virtuality based on five dimensions. Taken together, these dimensions represent a composite virtuality index that characterizes any team environment. The TVI provides a defined and measurable way to understand team environments as well as investigate the impact of these environments on any number of defined outcomes. For this research, individual satisfaction and engagement were investigated; however, a significant number of other team and individual outcomes can now be explored. As
previously discussed, all teams fall somewhere on the virtuality index, so this instrument can be used within the context of any team environment.

**Dimensions not Included in the model**

While a primary contribution of this research includes those dimensions outlined in the virtuality index, additional insights are found within the results of the analysis. The dimensions of imbalance and communication richness were not included within the final TVI, yet they were each included in prior attempts to operationalize and measure virtuality (Berry, 2011; Ganesh & Gupta, 2010; O'Leary & Cummings, 2007). This section explores these findings.

**Imbalance**

In this dissertation, imbalance was defined as the number of work locations and the number of team members at each location. Several notable past studies included some variation of this dimension (Arling & Subramani, 2011; O'Leary & Cummings, 2007; Schweitzer & Duxbury, 2010). This research attempted to measure the influence of team configuration. From an interaction and communication standpoint, it would seem that imbalance would influence team outcomes. A team with members at locations by themselves may feel more isolated than individuals located at sites with multiple team members (O'Leary & Cummings, 2007). Additionally, Polzer, Crisp, Jarvenpaa, and Kim (2006) found that team configurations and member imbalance contributed to the formation of subgroups that ultimately led to increased conflict and decreased trust. However, within this study, in the context of measuring team
virtuality, including the dimension of imbalance significantly altered the reliability of the overall model and virtuality index.

One possible explanation for this result, within this sample, is that groups were generally balanced. In other words, there was not enough variance within the sample to influence the model. For the imbalance variable, the mean was 1.79 on a 12-point scale, with a score of 1 representing a completely balanced environment. Overall, 43% (n = 38) of the teams were completely balanced. This would indicate either all members were at the same location or the members were exactly evenly distributed across locations. Further investigation into the impact of team imbalance within the context of virtual teams is clearly warranted.

**Communication richness**
Within the literature on virtual teams, many studies have investigated the amount of electronic communication. A few studies have expanded this area of exploration by examining the communication richness of these interactions (Fiol & O'Connor, 2005; Ganesh & Gupta, 2010; Kirkman & Mathieu, 2005). For this dissertation, the dimension of communication richness attempted to capture both the *amount* and the *quality* of communications. The rationale for including this dimension is that teams utilizing technologies higher on the media richness scale would be considered less virtual on the virtuality index. Communication tools, such as video conferencing, are significantly more “media rich” channels for interactions, whereas email messages are very low on the richness continuum. Media richness considers (1) the ability to
allow for immediate feedback, (2) the number of cues, and (3) the level of focus on the individual (Daft & Lengel, 1986). The results indicate that including communication richness altered the reliability of the overall model and virtuality index; thus, it was excluded as a dimension.

In a study conducted by Ganesh and Gupta (2010), the authors characterized virtuality by looking at dispersion-related characteristics along with technology-related factors. The technology-related factors included both the level of technology usage for communication and the media richness of the communication tool utilized. Ultimately, these authors found that the amount of usage for the various communication tools was basically the same in all types of team environments ranging from highly virtual to traditional or collocated environments.

To investigate a similar finding within this study, additional analysis was performed by splitting the data into three groups based on the level of geographic dispersion and communication richness. Table 29 reflects the respondents in low, medium, and high levels of geographic dispersion. These groups are then compared by looking at the group means for the communication richness variable. All three groups have means between .48 and .53. ANOVA analysis conducted to test the differences between means indicated no significant differences between the levels of geographic dispersion and communication richness.
Table 29. Geographic Dispersion and Communication Richness

<table>
<thead>
<tr>
<th>Geographic Dispersion Level</th>
<th>Communication Richness Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Mean: 0.53267</td>
</tr>
<tr>
<td></td>
<td>N: 29</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation: 0.155586</td>
</tr>
<tr>
<td>Medium</td>
<td>Mean: 0.4918</td>
</tr>
<tr>
<td></td>
<td>N: 24</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation: 0.132638</td>
</tr>
<tr>
<td>High</td>
<td>Mean: 0.48212</td>
</tr>
<tr>
<td></td>
<td>N: 35</td>
</tr>
<tr>
<td></td>
<td>Std. Deviation: 0.13629</td>
</tr>
</tbody>
</table>

The data indicates within this sample that even in locations where members were co-located, they tended to use the same types of communication tools, such as email and text, and they used these tools with the same frequency. This is consistent with the findings of Ganesh and Gupta (2010), where they found a similar pattern of communication richness regardless of the level of geographic dispersion. One possible explanation—and a potential area for further exploration—is the type of work being performed. From a task standpoint, is there high-level interdependence and interaction required to achieve objectives? In their study, Ganesh and Gupta
(2010) looked at software development teams; however, within this study, the majority of the participants were in the insurance industry performing interrelated but potentially independent tasks.

As outlined within this research, communication richness was investigated as a potential dimension of the TVI. The argument is that the level of communication richness directly influenced the level of virtuality. Another direction for future research is to explore communication richness as a possible moderating variable that influences the relationship between virtuality and performance outcomes. Given a score for a team environment on the TVI, how does the level of communication richness, measured both by communication tool usage and type of communication, influence the level individual satisfaction or engagement? While communication richness did not statistically fit into the TVI, it may very well be an important consideration in virtual environments.

**Summary of Hypotheses**
As summarized in the results chapter, each of the hypotheses was rejected for the main effect and moderating variables. The level of team virtuality did not affect the level of individual satisfaction or engagement. Additionally, the influence of virtuality and the moderating variables of team tenure, individual tenure, team face-to-face meetings, and training did not significantly alter these same outcomes. This section further explores the data and analyzes these results.
Satisfaction and engagement
The hypotheses predicting the main effects of the level of team virtuality on the individual outcomes of satisfaction and engagement were not supported. Examination of the data suggests that the detection of any linear effects may have been hampered by ceiling effects seen on both the satisfaction and engagement variables. Ceiling effects are indicated when a significant portion of the sample population has scores at or close to the maximum, limiting the ability to make any distinctions between the participants. This section explores the extent of these ceiling effects; however, one significant implication of these results is that the use of virtual teams is not a threat to organizations, meaning the use of virtual teams does not automatically have a negative impact on individual satisfaction or engagement. Recall that within this sample, the average team scored higher than .5 on the TVI. This indicates that these teams can be characterized as more than 50% virtual, yet the scores for both individual satisfaction and engagement are so high it is difficult to distinguish between the participants. These results lend support to the notion that organizations can embrace the use of virtual teams without concern for adverse effects related to either individual satisfaction or engagement.

For satisfaction, the mean score was 6.18, and 42% of the sample (n=37) scored the maximum score of 7, and 76% (n=68) scored 6 or above on this seven-point scale. Only 3 respondents scored below the scale midpoint of 3.50. Figure 7 is the scatterplot depicting the relationship between virtuality and individual satisfaction in
this sample. In looking at the top part of the scatterplot, the ceiling effect is illustrated with 76% of the plots being on or above 6.0.

Figure 7. Satisfaction and Virtuality

A similar pattern was apparent in the examination of the engagement variable. For engagement, the mean was 6.03, and a total of 40% of the sample (n=30) scored 6.44 or higher on the 1-7 scale of engagement, and only 2 respondents (2%) scored below the scale midpoint of 3.50. The scatterplot in Figure 8 displays the relationship between the virtuality and engagement variables. Again, the scatterplot reveals the
ceiling effect where a significant portion of the sample scores are at or close to the maximum, limiting the ability to make any distinctions between the participants. For the engagement variable, 68% of the responses \( (n = 59) \) are above 6.0 and 77% of the responses \( (n = 77) \) are above 5.0.

**Figure 8. Engagement and Virtuality**

Another interesting aspect of the virtuality and engagement relationship relates to the level of virtuality and the variance in engagement scores. Within the sample, there are 10 data points with scores lower than .5 on the TVI, indicating lower virtuality. For these teams, engagement scores are uniformly high (above 6.5). For the rest of the
sample, once the level of virtuality moves above .5, there is a much greater variance in engagement scores, ranging from 1–7 on a 7-point scale, but with the majority of them being above a 5. One possible interpretation is that engagement may be consistently higher in low virtuality environments and have broader range in high virtuality environments because of the effects of geographical distance, temporal distance, isolation, technological reliance, and leader distance. The same may be true for satisfaction, although the pattern in my data is not as distinct as it is for engagement.

Another interpretation may be that flexible work practices, such as working from home 1–3 days a week, may improve workplace engagement. People who work at home 1–3 days a week fall in the lower virtuality range (i.e., .1 to .5 on the TVI), and the data shows that people in this range uniformly score high in engagement. In other words, it is possible that introducing any of the dimensions included in the TVI to a limited extent may not harm individual engagement and may even improve it.

While the tests of hypotheses for the main effects found no linear relationships within this sample, the scatterplots indicate that further research and investigation is warranted. These relationships should be explored using sample populations in a variety of contexts, which are characterized by a wider range in variability in both individual satisfaction and engagement.


**Moderating Variables**

This section provides further exploration and analysis regarding the results of the moderating variables. While the hypotheses were not supported, the data provides numerous insights into team characteristics and practices.

Individual and team tenure—Experience in virtual environments

For individual tenure, the mean score was 4.44 with 82% of respondents (n = 72) scoring 4.0 or higher. This indicates that they have been a part of their primary team more than 1 year. Out of that group, 28% of the respondents (n = 25) scored 5.0, which means that they have been on their team for more than 2 years.

For team tenure, the mean score was 4.59 with a range of teams being in existence for 3–6 months to over 2 years. A full 76% (n = 67) of the teams have been in existence for more than 2 years, and another 11% (n = 10) have been in existence between 1–2 years. Table 30 outlines the responses to the question on team tenure.

**Table 30. Team Tenure**

<table>
<thead>
<tr>
<th>How long has your team been in existence?</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–6 months</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>6–12 months</td>
<td>7</td>
<td>8.0</td>
</tr>
<tr>
<td>1–2 years</td>
<td>10</td>
<td>11.4</td>
</tr>
<tr>
<td>More than 2 years</td>
<td>67</td>
<td>76.1</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100.0</td>
</tr>
</tbody>
</table>
There are some key implications related to the individual and team tenure findings within this study. Clearly, the results from this sample support the notion that virtual teams are widely used in some organizations. The data shows that many of the teams are more virtual than not. Additionally, the elevated levels of tenure may have played a significant role in influencing the high individual satisfaction and engagement scores.

The use of virtual teams
The scores within the sample on the TVI ranged from .08 (low virtuality) to .92 (high virtuality). The mean was .64 with a standard deviation of .19. Figure 9 displays the scatterplot for virtuality and individual tenure. In this sample, the average team scored higher than .5 on the TVI (indicated on the top half of Figure 9). This indicates that the majority of these teams were operating in an environment that was more than 50% virtual. Additionally, the majority of individuals have been working in their current environment for more than a year, and three-fourths of the teams have been in existence for more than two years. To summarize, (1) the teams average more than 50% on the TVI, (2) 87% of the teams have existed for more than a year, and (3) 96% of the individuals have been a part of their team for more than 6 months. So, not only are these teams operating in a virtual environment, but individuals are also very experienced working in this setting. There may have been a time when virtual teams were formed as temporary project teams. Individuals would come together to accomplish a specific objective and then disband upon completion. This appears to no longer be the case. Individuals are now permanently working in a virtual capacity.
These results challenge the notion of a traditional, purely face-to-face team. This may no longer be a valid way to accurately describe a team environment.

**Figure 9. Team Virtuality and Individual Tenure**

I recognize that this effect may only be an indication of this sample; however, it supports the argument presented by several prior researchers. Orhan (2014) indicated that virtuality is a characteristic that can be applied to just about every team. Other researchers argued that the use of virtual teams is not only widespread, but in many organizations, virtual teams have replaced traditional teams (Gibson et al., 2014; Peñarroja et al., 2013). Within this sample, virtual teams—or, more specifically,
teams that are more than 50% virtual—were more of the norm than traditional, face-to-face teams.

The impact of tenure
Building on the prior discussion, where teams are virtual and that individuals have extensive experience in these environments, what are the implications of high amounts of individual and team tenure? Earlier in this chapter, I discussed the results demonstrating the high levels of individual satisfaction and engagement within this sample. One possible explanation for these results is the high amount of tenure. These results provide support that the potential negative effects of virtualness may be reduced over time. This is consistent with earlier findings, where Ortiz de Guinea et al. (2012) found that in longer-term teams, there was no negative effect on either team performance or satisfaction. These results may also be explained by group development theory. There is a significant amount of research that supports the idea that groups develop over time (Tuckman & Jensen, 1977; Wheelan & Mckeage, 1993). The results in this study may be linked to the developmental stage of each team. This topic will be explored much further in a later section.

Face-to-face meetings—Are they critical?
The results of the data related to the frequency of team face-to-face meetings provide insight into team practices. Table 31 summarizes the survey responses indicating how often teams meet in a face-to-face setting. More than half the individuals surveyed
indicated that their team meets only once or twice a year in a face-to-face setting, with a full 87% of the respondents (n = 77) indicating their teams meet once a quarter or less in this type of setting.

### Table 31. Team Face-to-Face Meetings

<table>
<thead>
<tr>
<th>How often do you meet face-to-face?</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>10</td>
<td>11.4</td>
</tr>
<tr>
<td>Once or twice a year</td>
<td>54</td>
<td>61.4</td>
</tr>
<tr>
<td>Quarterly</td>
<td>13</td>
<td>14.8</td>
</tr>
<tr>
<td>Monthly</td>
<td>6</td>
<td>6.8</td>
</tr>
<tr>
<td>A few times a month</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Weekly</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>A few times a week</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Daily</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100</td>
</tr>
</tbody>
</table>

Given the high mean scores for satisfaction (6.18) and engagement (6.03), these findings suggest that virtual teams meeting in face-to-face settings on a very limited basis or perhaps not at all may not experience a negative impact on individual satisfaction and engagement scores. Building on this general finding, the association between the number of face-to-face meetings with individual satisfaction and engagement was further explored by creating group comparisons. Within this sample, 11% of the respondents (n=10) indicated that their teams never meet in a face-to-face environment. The outcomes for these 10 individuals were compared to the rest of the
sample. Table 32 displays the group means for comparison. The data reveals that the means for both groups are nearly identical on both the satisfaction and engagement variables, with the results slightly higher for satisfaction for the group comprised of teams who never meet face-to-face.

**Table 32. Face-to-Face Meetings and Satisfaction & Engagement—All**

<table>
<thead>
<tr>
<th></th>
<th>Mean for Satisfaction</th>
<th>Mean for Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never meets in a face-to-face setting (n=10)</td>
<td>6.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Meets daily to annually in a face-face setting (n=78)</td>
<td>6.15</td>
<td>6.04</td>
</tr>
</tbody>
</table>

In order to test the significance of these means, a new comparison group was created with similar sample sizes. In the previous example, the group that never meets face-to-face was compared to all other respondents within the sample. For additional analysis, the original group (those who never meet face-to-face) is being compared to a new group of the same size. This new group consists of the respondents who meet the most frequently (n=11; six who indicated monthly face-to-face meetings, one who indicated face-to-face meetings a few times a month, one who indicated weekly face-
to-face meetings, two who indicated face-to-face meetings a few times a week, and one who indicated daily face-to-face meetings). Table 33 displays comparisons for these groups.

**Table 33. Face-to-Face Meetings and Satisfaction & Engagement—Comparison Group**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean for Satisfaction</th>
<th>Mean for Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Meetings Group (n=10)</td>
<td>6.4</td>
<td>6</td>
</tr>
<tr>
<td>Frequent Meeting Group (n=11)</td>
<td>5.7</td>
<td>6.4</td>
</tr>
</tbody>
</table>

An independent t test for the difference in means for satisfaction produced a t value of 1.15, \( p = .13 \). The t for the test of the means for engagement was 1.14, \( p = .12 \). So, neither group test met the conventional standards for statistical significance, even though there were trends toward significance.

Within this sample, the data implies that face-to-face meetings are not critical drivers of individual satisfaction and engagement. Within these sub-groups, there was no significant difference between those individuals who interacted regularly in a face-to-face setting and those who never did. However, as noted in the section on tenure, a high percentage of individuals and teams within this sample have experience working
together. As groups develop and relationships are formed, the importance of face-to-face interactions may be lessened. Additionally, the types of tasks performed and the level of interdependence between members may also influence the importance of face-to-face interactions.

**Training—Still an opportunity**
Within the 2016 Culture Wizard survey, titled “Trend in Virtual Teams,” 85% of the participants identified as being involved with a virtual team. Within this same survey, only 22% of the respondents participated in training to improve their productivity while working on a virtual team. Consistent with these results, the survey from this research revealed that there is a lack of training related to working in a virtual environment. The results, summarized in Table 34, indicate that almost half of the survey respondents had received no formal training to help them navigate the challenges of working in a virtual team environment. Another 38% of the respondents reported that they had received less than 4 hours of training. Only 10% of those surveyed received more than 1 day of training.
Table 34. Training

<table>
<thead>
<tr>
<th>Amount of Training Received</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>42</td>
<td>47.7</td>
<td>47.7</td>
</tr>
<tr>
<td>1 hour or less</td>
<td>17</td>
<td>19.3</td>
<td>67</td>
</tr>
<tr>
<td>1–4 hours</td>
<td>17</td>
<td>19.3</td>
<td>86.4</td>
</tr>
<tr>
<td>1 day</td>
<td>3</td>
<td>3.4</td>
<td>89.8</td>
</tr>
<tr>
<td>More than 1 day</td>
<td>9</td>
<td>10.2</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

As shared earlier, teams rely heavily on communication technologies to accomplish their work. Research has demonstrated that technology based communications can have a negative impact on team performance, and team performance outcomes can be improved through targeted training on communicating through the use of electronic media (Cornelius & Boos, 2003). Rosen et al. (2006) identified several virtual team training areas adopted by organization, including (1) leading virtual meetings, (2) coaching and mentoring virtually, (3) using communication technologies, (4) establishing trust and resolving conflicts in virtual teams, (5) using the appropriate technology to fit the task, (6) rewarding and recognizing virtually, and (7) selecting virtual team members. Additional researchers have advocated specific training for
team leaders focused on team building and collaboration in a virtual environment (Ford et al., 2016).

**Additional Findings**

**Technological reliance—No distinction between virtual and traditional teams**

As discussed throughout this dissertation, virtuality is a construct that is best characterized along a continuum when describing teams. In fact, as virtuality has been operationalized in this dissertation through the TVI, all teams fall somewhere on this continuum. Where there once was a clear distinction between virtual teams and traditional teams, the results of this study suggest that this may no longer be the case. The data regarding technological reliance provides support for this position. In this study, 72% of all respondents indicated that they rely on technology for more than 80% of their work. Table 35 outlines the full breakdown of the results regarding technological reliance. To summarize these results within this sample, the data indicates that all teams, regardless of geographic dispersion, rely heavily on technology to accomplish their work.
Table 35. Technological Reliance

<table>
<thead>
<tr>
<th>Percentage of Work Completed Solely by Using Communication Technology (No Face-to-Face Interactions)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>5</td>
<td>5.7</td>
</tr>
<tr>
<td>40%</td>
<td>9</td>
<td>10.2</td>
</tr>
<tr>
<td>60%</td>
<td>11</td>
<td>12.5</td>
</tr>
<tr>
<td>80%</td>
<td>26</td>
<td>29.5</td>
</tr>
<tr>
<td>100%</td>
<td>37</td>
<td>42.0</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Additional analysis was performed by splitting the results into three groups based on the level of geographic dispersion. Table 36 reflects the respondents in low, medium, and high levels of geographic dispersion. These groups are then compared with the group means for technological reliance. All three groups are high in technological reliance, with means between .74 and .82. This indicates that all of these teams, regardless of geographic dispersion, rely heavily on technology to accomplish their work. ANOVA analysis conducted to test the differences between means indicated no significant differences between the levels of geographic dispersion and technological reliance.
Table 36. Geographic Dispersion Groups and Technical Reliance

<table>
<thead>
<tr>
<th>Geographic Dispersion Level</th>
<th>Technical Reliance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Low</td>
<td>0.73793</td>
</tr>
<tr>
<td>N</td>
<td>29</td>
</tr>
<tr>
<td>Medium</td>
<td>0.81667</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
</tr>
<tr>
<td>High</td>
<td>0.8</td>
</tr>
<tr>
<td>N</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>0.78409</td>
</tr>
<tr>
<td>N</td>
<td>88</td>
</tr>
</tbody>
</table>

There may have been a time when the use of communication technologies and heavy reliance on technology was more prevalent in virtual teams, but this appears to no longer be the case. Many teams, regardless of their environment, accomplish much of their work through the use of technology. Avolio and Kahai (2003) described the “revolution” in many organizations today where the majority of interactions are conducted through the use of communication technologies. What is noteworthy is that
this is not limited to virtual environments; this applies to all environments. Team communication, which is critical to supporting tasks and accomplishing goals, takes place using communication technology.

**Virtual team development**

Outside of the analysis related to the specific variables, another explanation for the results comes from a group development perspective. There is an extensive body of literature to support the notion that groups develop over time (Tuckman & Jensen, 1977; Wheelan & Mckeage, 1993). Given the amount of individual and team tenure described earlier within this sample, a plausible explanation for the high levels of both individual satisfaction and engagement may be linked to the developmental stage of each team. Satisfaction has been linked to those characteristics that are present in the higher stages of team development (Haines, 2014). This section explores models of group development and how they may apply in this setting.

One of the most cited articles on group development comes from Tuckman (1965). Tuckman’s model, based on a linear sequence, includes the stages of forming, storming, norming, and performing. Tuckman referred to the first stage of group development as forming. The forming stage is characterized by orientation, testing, and dependence. At this stage, individual roles and expectations are not clear. Members test and form interpersonal and task boundaries. In the storming stage, conflict and polarization occur in both the interpersonal and task areas. Members may
disagree on how the group operates and even what the group goals may be. Individuals may resist the influence of the larger group. The group’s challenge in this stage is to create an agreed upon set of goals, values, and work processes (Wheelan & McKeage, 1993). As the group transitions to the norming stage, there is a feeling of cohesiveness within the group. Positive working relationships are established and there is increased clarity around roles and responsibilities. The group is actively planning how it will achieve its goals and objectives. In the performing stage, relationships have been established and structural challenges have been settled. Given that there has been resolution to the majority of the issues identified in the prior stages, the group can now focus on goal attainment. This stage is characterized by high productivity and effectiveness.

Building on Tuckman’s (1965) model and by conducting additional research, Wheelan (2005) proposed an integrated model of team development. While her model is also linear, it takes the perspective that groups “mature” as they continue to work together through the stages of development. The core issues associated with development revolve around dependency, counterdependency, and issue of trust. The stages of development in Wheelan’s model include (1) dependency and inclusion, (2) counterdependency and fight, (3) trust and structure, and (4) productivity and effectiveness. Figure 10 outlines the key aspects of each stage of the model.
### Figure 10. Wheelan's Model of Integrated Group Development

<table>
<thead>
<tr>
<th>Stage 4</th>
<th>Productivity and Effectiveness</th>
<th>The team is able to focus on productivity and effectiveness now that relationships have been established and conflicts resolved.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 3</td>
<td>Trust and Structure</td>
<td>As the group works through the conflict that was prevalent during the second stage, positive working relationships are established. There is increased open communication regarding task accomplishment. Alignment is reached regarding team operations and roles.</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Counterdependency and Fight</td>
<td>In the second stage, there is active conflict as the group addresses issues related to goals, roles, and procedures.</td>
</tr>
<tr>
<td>Stage 1</td>
<td>Dependency and Inclusion</td>
<td>During the initial stage, members have a high dependency on the formal leader. Individuals are primarily concerned with safety and inclusion.</td>
</tr>
</tbody>
</table>

While both the Tuckman (1965) and Wheelan (2005) models were formulated based on research conducted in traditional group settings—in other words, co-located environments—there is some research that suggests that group development may be different in a virtual setting (Haines, 2014). Using a grounded theory approach, Sarker, Lau, and Sahay (2000) developed a four-stage model of virtual team development, which includes initiation, exploration, integration, and completion. The model stages were later renamed to initiation, exploration, collaboration, and culmination (Sarker & Sahay, 2003). The original research involved multiple project teams over a 14-week period.
The initiation stage is characterized by uncertainty around roles and responsibilities and a lack of mutually agreed upon goals. Within the virtual setting, there is additional ambiguity regarding the expected norms around the use of communication technologies for interactions.

Time-space adds to the uncertainty since there is no name to the face, and members are separated by time-zones, geographical distances, and culture, giving a sense of the unknown on one hand, and the wonder of a new experience on the other. (Sarker et al., 2000, p. 51)

Movement to the next stage begins to happen as members establish their “presence” through various communication technologies.

The second stage is exploration, which is characterized by the virtual presence of all team members. Members explore and establish communication patterns and expected norms of behavior. Team cooperation begins as members start to develop their sense of identification with the larger team. Active communication and information sharing form the basis for collaboration and task accomplishment. During this stage, some individuals may be conflicted between individual and team objectives.

The collaboration stage of virtual team development involves a high level of multi-directional communication and coordinated action. A common and shared frame of reference is established where all members align on their roles, goals, and norms related to both team processes and communication. A shared team identity is formed, and members have established mutual trust and respect for each other. Given the
mature level of relationships, discussions around team issues and conflict can be openly resolved.

As indicated, this model was formulated based on the observations of virtual project teams; thus, the model includes the final stage of culmination, which involves the disbanding of the team.

All three models described here outline a linear sequence of development and clearly involve a time element. Within the literature, there is general agreement that groups develop over time. Tuckman’s (1965) model was included as it continues to be one of the most widely cited references on group development. Wheelan’s (2005) model is important because her research advocates that groups not only develop but also mature over time. Additionally, she later found that teams that met together longer reported to be at a higher a stage of development (Wheelan, Davidson, & Tilin, 2003). While there has not been extensive research on group development in virtual teams, the model proposed by Sarker et al. (2000) outlines many consistent aspects of group development in this type of environment. However, the authors identified several unique challenges within a virtual setting, such as the expected norms around the use of communication technologies and members effectively establishing a virtual presence.
With an understanding of the linear stages of group development and implications of time, these theories may help to explain the results of this study. Recall that within this sample, 87% of the teams have been in existence for more than a year, and a full 96% of the individuals have been a part of their teams for more than 6 months. This is an ample amount of time to work through the issues described in the earlier stages of development within each of these models. Consistent with the later stages of team development in all the models, a team identity is formed, trust is established, roles are clarified, and shared goals are agreed upon. Specific to a virtual setting, according to Sarker et al. (2000), norms are established related to technology use, communication, and presence. It is conceivable that many of the teams within this study are operating at a higher stage of development, helping to explain the high level of individual satisfaction and engagement. Further support for this argument is found in research conducted by Haines (2014), where he argued that virtual teams develop much the same way as traditional teams. He postulated that virtual teams develop through the number of interactions and the amount of time. Virtual teams that have overcome challenges and obstacles develop faster and have higher levels of trust and commitment. Lastly, he found that satisfaction in a virtual team was linked to items found in higher stages of team development, such as trust, commitment, and performance.

With the development of the TVI, there is a clear opportunity to investigate how the level of team virtuality influences team development. As this discussion has
articulated, another critical aspect of this exploration would be looking at this process longitudinally.

**Limitations**

There are several methodological limitations that must be noted within this research. First, a high percentage of the survey respondents (76%; n = 67) came from one functional area within one organization. Given this, there may be limited opportunities to make general conclusions based on the results. Second, within this organization, the use of virtual teams is extensive. As demonstrated by the data, to a large extent, individuals have a significant amount of experience working in a virtual environment and their teams are well established. All teams fell somewhere on the virtuality continuum, with the majority of teams being scoring higher than .5 on a 0–1 scale. Third, there was a lack of variance in the individual satisfaction and engagement scores for the participants. Employee opinion survey results within this organization consistently report high levels in these areas. Given this lack of variance, attempts to investigate the relationship with the outcome variables as well as the moderating variables were difficult. Last, this was a cross-sectional study. Within the context of a virtual environment, tenure is clearly a critical consideration. Further research initiatives should investigate these same relationships in a longitudinal study.
Summary
This chapter provided an overview and discussion of the key contributions of this research. The Team Virtuality Index (TVI) provides a clearly defined and measurable way to characterize virtual team environments. This instrument provides a consistent method for measuring the impact of virtual team environments on a range of performance outcomes. I then explored the ceiling effect of the results around satisfaction and engagement. While the hypotheses were not supported, the data suggests that virtual environments do not necessarily have a negative impact on these outcomes. Based on this sample, the data indicated that teams and individuals had significant experience working in a virtual manner. The data also found that face-to-face meetings may not be critical drivers of individual satisfaction and engagement, particularly in tenured teams. Almost half of the survey respondents received no formal training regarding working in a virtual environment. Consistent with prior findings, training remains an area of opportunity. There was a time when there was a clear difference between a traditional team and a virtual team regarding the use of technology. The results indicate that this may no longer be the case. Lastly, group development theory may help explain the results. With the significant levels of individual and team tenure, these teams may be operating at a higher stage of development, accounting for the high levels of individual satisfaction and engagement.
The limitations of the study are primarily driven by the sample population within one organization. The next chapter outlines future research opportunities and implications for practitioners.
Chapter 6: Future Research & Implications for Practice

This chapter outlines future research opportunities, along with several implications for practitioners. First and foremost, additional research and investigation is needed for the TVI. This includes testing the current dimensions as well as identifying and exploring additional dimensions to refine the instrument. Another key research opportunity is to examine the virtual team development process to understand whether it aligns with traditional development models or if a different framework is needed. Lastly, I briefly outline research opportunities around generational differences, technology, and innovation. The implications for practice include recommendations on adopting workplace flexibility practices, utilizing face-to-face meetings up-front, and expanding the amount of virtual team training.

Future Research

Research on the TVI
This research is a starting point rather than a final product. I have established a conceptual framework and measure with the Team Virtuality Index (TVI) that needs to be further explored and refined. I have included five dimensions within the final model. Verification of these dimensions should be conducted. Additionally, further investigation into the dimensions not included, which are imbalance and
communication richness, should be undertaken. There is a reasonable level of support within the literature that both of these dimensions contribute to the level of team virtuality. Additional dimensions may also provide further refinement of the instrument. Culture was considered out of scope for this dissertation; however, in the context of virtual teams, it is clearly a dimension that applies to many virtual teams. A further opportunity of exploration would be to test the TVI in different contexts and different industries. As identified throughout this dissertation and within the literature, a clear and unified measure of virtuality is perhaps the most critical need within this field of study. The creation of the TVI is a first step in the process.

With a validated TVI, there is a clearly defined and measurable way to capture this characteristic for any team. This gives us the ability to better compare organizational and team environments. With this measure, a range of individual and team outcomes can now be explored. Prior research has investigated outcomes related to team effectiveness, including decision making, creativity, performance, and innovation. Additional areas of investigation have included trust, satisfaction, goal commitment, and conflict management. The TVI provides the common measurement to allow for comparisons across different organizational environments.

Another significant opportunity for further exploration is around moderating conditions within a virtual environment that influence team outcomes. Within this dissertation, individual and team tenure were investigated along with training and the
number of face-to-face meetings. While the results here were not significant, further testing of these moderating variables in additional contexts and industries is warranted. The dimension of communication richness, which was part of the original conceptual model, was not included in the final TVI. This may mean that it should be explored as a moderating variable. In other words, given a certain degree of team virtuality, how does the level of communication richness influence outcomes such as satisfaction and engagement? Communication richness was based on the amount and type of technology usage. There are a number of other moderating variables that can be explored based on the level of virtuality measured by the TVI. Examples of potential moderators are team leadership, task type, and personality. In addition to individual satisfaction and engagement, additional outcomes to explore include items such as performance, knowledge sharing, decision making, innovation, and trust.

**Team development**

The results of this study suggest that the influence of individual and team tenure plays a significant role in individual and team outcomes. In their review of virtual team research, Hertel et al. (2005) concluded that many of the challenges and disadvantages of virtual teams diminish in longer-term teams. The study of team development explores how teams develop over time; however, there has been little research investigating the development of virtual teams. Virtual teams may not follow the traditional models of team development, which include Tuckman’s (1965) forming-storming-norming-performing model or Gersick’s (1988) punctuated equilibrium model (as cited in Kirkman, Gibson, & Kim, 2012). There is a significant
opportunity to conduct a longitudinal research to understand how virtual teams develop and to explore if or how they may align with traditional models of team development, or if a new model is warranted. Additionally, this type of research could help identify the key actions, behaviors, and practices that contribute to successful virtual team development.

**Additional research areas**
Given that the field of virtual team research is relatively new, there are an endless number of potential areas of further exploration. While millennials in the workplace is a popular topic in the mainstream media, there is certainly an opportunity to explore the broader area of generational implications with the use of virtual teams. Are there significant differences in either inputs, such as the level of technology use, or outcomes, such as job performance or satisfaction based on different age groups? This is an area with many practical applications including hiring, selection, and managing employees.

In this study, the level of technology usage and the media richness of the selected communication tool were shown to be basically the same in all types of teams, regardless of the level of virtuality. Further exploration into the amount and types of communications is needed, given the rapid advancements in technology. Perhaps five years ago, email may have been a primary method for communication, and today it may be instant messaging. What are the implications within the context of a team
environment? I would argue that traditional teams, because of the use of technology, are becoming more virtual regardless of their physical proximity.

Another “hot topic” in many organizations is around innovation. In some respects, the process of innovation may run counter to being in a virtual environment. Innovation teams or agile development teams are frequently co-located to foster both formal and informal interactions to improve the design process. How does this type of process happen in a virtual environment? As a research starting point, what is the relationship between the level on the TVI and innovation? Is the creative process helped or hampered due to the level of virtuality? There are a number of research avenues to pursue around this topic.

**Implications for Practice**

While there is still much to learn about virtual teams and performance, there are several implications for organizations.

First, while the use of virtual teams has been shown to be widespread in many organizations, there may some traditionalists still reluctant to embrace this new way of working. Reasons for this hesitation may include the impression that it will have a negative impact on productivity or reduce employee engagement. The results of this study indicate that virtual teams are not a threat to organizations. Additionally, adopting certain popular employee-centric practices, such as workplace flexibility
where employees work from home a few days a week, will not have a negative effect on employee satisfaction and engagement. It may even have a positive effect on these outcomes. This can also boost productivity and provide additional flexibility for employees while saving time and travel expenses (Lepsinger & DeRosa, 2015). The development of the TVI provides a way to further explore the nuances of these practices and determine the optimal amount of home and office time.

Second, if possible, leaders should try to coordinate face-to-face meetings early in the life-cycle of the team. Although this research indicated that the lack of face-to-face meetings did not necessarily have a negative influence on individual satisfaction and engagement, these results may have been driven by the high level of individual and team tenure. As discussed earlier, many of the challenges of virtual teams are diminished over time. Conducting face-to-face meetings and team-building activities up-front may accelerate this process (Gibson et al., 2014).

Third, within this study, there was a limited amount of training provided to prepare individuals for working in a virtual environment. This is consistent with research findings, which indicated that training to enhance virtual team performance was not a common practice in most organizations utilizing virtual teams. Rosen et al. (2006) speculated that this could be a result of organizations not recognizing the extent of the challenges of working on a virtual team. Another explanation may be the belief that
existing training programs focusing on group development, managerial skills, and leadership apply the same way in all types of environments.

Regardless of the reasons for the lack of virtual team training, this may be an indication that these teams have not achieved their full potential. Virtual team training is advisable and should include normal content around team development along with targeted content specific to virtual environments, such as the use of communication technologies (Hertel et al., 2005). Virtual team training with a specific focus on group interactions has been shown to improve trust, teamwork, and individual satisfaction (Warkentin & Beranek, 1999). While it has not been a focus of this study, research also suggests additional training for virtual team leaders. Topics that include role clarification, goal setting, delegation, and conflict resolution are important skills for managers who have limited or no face-to-face interactions with team members (Ford et al., 2016). Additionally, Rosen et al. (2006) provided the following assessment on training for virtual team leaders:

"Our assessment of the future value of additional virtual team training indicated that training to provide the appropriate skills in leading virtual teams, in managing the dynamics of virtual teams, and in selecting the appropriate communications technology for a team continue to be quite valuable. (p 243)"

Virtual team training remains both an implication for practice and an area of opportunity for future study. Further research into the types of training for both individuals and leaders is warranted, as training has been shown to improve
performance and aid in team functioning. Given the broad use of virtual teams, this is a critical area for additional focus.

**Summary**

This chapter provided recommendations for future research areas. The most significant opportunity is to continue to test and refine the TVI. The development of the instrument provides a consistent method to compare team environments. There is also a need to research virtual team development, comparing existing models and exploring new ones. Additional research areas mentioned included generational differences, technology, and innovation. Implications for practice included the using of virtual work practices, conducting face-to-face meetings early in the life-cycle of a team, and investing in virtual team training.
Appendix A: Virtual Team Survey Instrument

Consent Form

Background Information: The purpose of this study is to create a clear definition and measure of team virtuality and compare the level of virtuality with individual job satisfaction and individual engagement.

Procedures: Upon your agreement to participate in this study, you will complete a brief survey that will take less than 10 minutes.

Risks and Benefits Associated with the Study: This study does not have any known risks. The benefits in this study include providing a clear definition and measure of virtual teams, allowing for better understanding and comparisons of team and organizational effectiveness.

Confidentiality: This survey is anonymous. The records of this study will be kept in a locked office at the university, preventing any breach of confidentiality. Should the study ever become published material, your name and organization will in no way be linked to the study, nor will it mention your personal involvement.

Voluntary Nature of the Study: Your decision whether or not to participate will not affect your current or future relations with your organization, this student researcher, or with Benedictine University faculty. You are free to withdraw at any time without affecting your relationship with your organization, the researchers, or Benedictine University.

Contacts and Questions: The researcher conducting this study is Dan Blood, under the supervision of Dr. James Ludema, / Director, Center for Values-Driven Leadership at Benedictine University. If you have any questions or concerns regarding this study, please ask the student researcher at this time. If questions or concerns arise at a later time, you may direct them to Dan Blood at 630-277-6961 or to Dr. James Ludema at 630-829-6229. Questions and concerns may also be addressed to Alandra Devall, Ph.D., Chair, Institutional Review Board, Benedictine University, 5700 College Road, Lisle, Il 60532, 630-829-6295 or adevall@ben.edu.

   a. By checking below, you have agreed to the above information in its entirety.
2. Please list the first name of each member of your team including yourself starting with the team leader. For the first few questions, the survey will ask you some information about each person.

3. Please indicate how long this person has been a member of the team:
   a. 0–3 months
   b. 3–6 months
   c. 6–12 months
   d. 1–2 years
   e. More than 2 years

4. How would you describe the distance between the place where your team leader does most of his/her work and the place where this team member does most of his/her work?
   a. N/A this person is the leader
   b. Same location (within the same floor in the same building)
   c. Different floor within same building
   d. Different building within same complex
   e. Different location with same metropolitan area
   f. Different area within the same state
   g. Different state
   h. Different country

5. How would you describe the distance between the place where this team member does most of his/her work and the place where you do most of your work?
   a. N/A this person is the leader
   b. Same location (within the same floor in the same building)
   c. Different floor within same building
   d. Different building within same complex
   e. Different location with same metropolitan area
   f. Different area within the same state
   g. Different state
   h. Different country

6. To the best of my knowledge, how many days a week does this team member work in a location physically separate from any other team member?
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4
   f. 5
7. To the best of my knowledge, this team member meets face-to-face with at least one other member of the team:
   a. Daily
   b. A few times a week
   c. Weekly
   d. A few times a month
   e. Monthly
   f. Quarterly
   g. Once or twice a year
   h. Never

8. Please select each time zone represented on the team:
   a. EST
   b. CST
   c. MTN
   d. PST
   e. Outside US

9. What is the number of different official office locations of your team members and how many members are based in each location? If you only have one location, all members would be based in location 1. If you have multiple offices, how many team members are based in each location? If someone works from home full-time, this should be counted as a location.

10. How often does your primary team meet together in a face-to-face setting?
    a. Daily
    b. A few times a week
    c. Weekly
    d. A few times a month
    e. Monthly
    f. Quarterly
    g. Once or twice a year
    h. Never

11. How long has your team been in existence?
    a. 0–3 months
    b. 3–6 months
    c. 6–12 months
    d. 1–2 years
    e. More than 2 years
12. Select the frequency with which you use each of the following communication methods:
   a. Face-to-face
   b. Video conferencing
   c. Web conferencing
   d. Voice/phone
   e. Chat
   f. Email
   g. Text
      i. Every day
      ii. A few times a week
      iii. Once a week
      iv. A few times a month
      v. Once a month or less
      vi. A few times a year
      vii. Never

13. Percentage of work completed solely by using communication technology (no face-to-face interactions):
   a. 20
   b. 40
   c. 60
   d. 80
   e. 100

14. The amount of training I have received related to working in a virtual environment:
   a. None
   b. 1 hour or less
   c. 1–4 hours
   d. 1 day
   e. More than 1 day

15. Job Satisfaction:
   a. All in all, I am satisfied with my job.
   b. In general, I don’t like my job.
   c. In general, I like working here.
      i. Strongly Agree
      ii. Agree
      iii. Somewhat Agree
      iv. Neutral
      v. Somewhat Disagree
      vi. Disagree
16. Engagement:
   a. At my work, I feel bursting with energy
   b. At my job, I feel strong and vigorous
   c. I am enthusiastic about my job
   d. My job inspires me
   e. When I get up in the morning, I feel like going to work
   f. I feel happy when I am working intensely
   g. I am proud of the work that I do
   h. I am immersed in my job
   i. I get carried away when I am working
      i. Everyday
      ii. A few times a week
      iii. Once a week
      iv. A few times a month
      v. Once a month or less
      vi. A few times a year
      vii. Never

Additional Demographic Information Collected

- Gender
- Age
- Race/Ethnicity
- Organizational Size
- Industry
- Functional Area
References


