

Measuring the self-efficacy of virtual leaders

by

Kelsey Len Couture

A.A., Barton Community College, 2013

B.S., Kansas State University, 2016

M.S., Kansas State University, 2019

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Psychological Sciences  
College of Arts and Sciences

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

2020

## **Abstract**

Accurately measuring the phenomena we intend to study is a foundational aspect of research and practice. Thus, the focus of this research was to develop a measure of Virtual Leader Self-Efficacy (VLSE), which had not been examined in the past. Two studies were conducted. The first served to develop the scale based on well-tested guidelines. A unidimensional factor structure was identified, and high reliability was maintained with very few items. A parallel form and an additional VLSE Trust scale was developed as well. The second study served to validate the scales and confirm the previous factor structure. By developing a reliable and valid measure of virtual leader self-efficacy, this study provides a robust foundation for future research in this area. Practical implications, strengths, limitations, and future directions of the research are discussed.

Measuring the self-efficacy of virtual leaders

by

Kelsey Len Couture

A.A., Barton Community College, 2013

B.S., Kansas State University, 2016

M.S., Kansas State University, 2019

A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Psychological Sciences  
College of Arts and Sciences

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

2020

Approved by:

Major Professor  
Dr. Patrick Knight, Ph.D.

# **Copyright**

© Kelsey Couture 2020.

## **Abstract**

Accurately measuring the phenomena we intend to study is a foundational aspect of research and practice. Thus, the focus of this research was to develop a measure of Virtual Leader Self-Efficacy (VLSE), which had not been examined in the past. Two studies were conducted. The first served to develop the scale based on well-tested guidelines. A unidimensional factor structure was identified, and high reliability was maintained with very few items. A parallel form and an additional VLSE Trust scale was developed as well. The second study served to validate the scales and confirm the previous factor structure. By developing a reliable and valid measure of virtual leader self-efficacy, this study provides a robust foundation for future research in this area. Practical implications, strengths, limitations, and future directions of the research are discussed.

# Table of Contents

List of Tables .....	xi
Acknowledgements.....	xii
Dedication.....	xiii
Chapter 1 - General Introduction .....	1
Virtual Teams .....	1
Virtuality.....	2
Self-Efficacy and Virtual Leadership .....	4
Virtual Leader Self-Efficacy (VLSE).....	6
Responsibilities of Team Leaders.....	6
Team Development.....	6
Team Performance Management .....	7
The Influence of Task Complexity and Team Interdependence .....	8
Discontinuity for Virtual Leaders .....	9
The Influence of Virtuality .....	10
Pillars of Effective Virtual Leadership .....	11
Communication.....	12
Virtual leaders need to facilitate the development of high-quality team communication standards. ....	13
Virtual leaders need digital fluency to exercise good judgement when selecting the appropriate mode of communication to match the type of messages. ....	15
Trust .....	16
Virtual leaders must be worthy of trust, and leaders must be capable of building trust in their team virtually.....	17
Virtual leaders need to be capable of maximizing predictability and reducing uncertainty wherever possible.....	20
Shared Leadership.....	23
Effective virtual leaders need to create an environment where shared leadership can develop.....	24

Virtual leaders need to identify and implement appropriate structural supports to enhance team functioning. ....	26
Virtual leaders need to be able to determine how virtual their team is and how interdependent the team’s tasks are to allow for a customized leadership approach.....	28
Virtual Leader Self-Efficacy Dimensions.....	28
Chapter 2 - Phase I: Scale Development.....	29
Item Generation Process .....	30
Study 1 Method.....	31
Sample and Procedure.....	31
Sample Characteristics.....	32
Measures .....	33
Virtual Leader Self-Efficacy.....	33
Demographics .....	34
Study 1 Results .....	34
Exploratory Factor Analysis .....	34
Reliability Analysis.....	35
Hypothesis 1 Results.....	36
Parallel Form of the VLSE Scale.....	36
VLSE Trust Scale .....	37
Chapter 3 - Phase II: Scale Validation .....	37
Hypotheses.....	38
Virtual Leadership Experience.....	38
Team Diversity.....	38
General Self-Efficacy.....	39
Organization-Based Self-Esteem .....	39
Sex.....	40
Leader’s Team Trust.....	40
Leadership Performance (Self-rated) and Team Performance (Leader-rated).....	41
Task Complexity.....	41
Virtuality .....	42
Age .....	43

Study 2: Method.....	43
Sample and Procedure.....	43
Sample Characteristics.....	44
Measures .....	45
Virtual Leadership Experience .....	45
Team Diversity.....	45
General Self-Efficacy.....	46
Organization-Based Self-Esteem .....	46
Leader’s Team Trust.....	47
Leadership Performance (Self-rated).....	47
Team Performance (Leader-rated).....	47
Task Complexity.....	48
Virtuality .....	49
Degree of Separation.....	49
Demographics .....	50
Results.....	50
Scale Reliability and Measurement Model .....	50
VLSE Scale.....	50
VLSE Parallel Form.....	50
VLSE Trust Scale .....	51
Validating the Scales.....	51
Testing Hypothesis 2.....	51
Testing Hypothesis 3.....	52
Testing Hypothesis 4.....	52
Testing Hypothesis 5.....	53
Testing Hypothesis 6.....	54
Testing Hypothesis 7.....	54
Testing Hypothesis 8.....	54
Testing Hypothesis 9.....	54
Testing Hypothesis 10.....	55
Testing Hypothesis 11.....	55

Testing Hypothesis 12.....	56
Testing Research Question 1 .....	56
Chapter 4 - Discussion .....	56
Limitations and Future Directions .....	61
Conclusion .....	62
References.....	64
Appendix A - Tables.....	85
Appendix B - Scales for Study 1.....	5
Informed Consent to Participate in the Study.....	5
General Survey Instructions.....	6
Calibration Items.....	6
VLSE Scale Instructions .....	7
Demographic Information.....	14
Debriefing Statement .....	14
Appendix C - Scales for Study 2.....	16
Informed Consent to Participate in the Study.....	16
General Survey Instructions.....	18
Calibration Items.....	18
VLSE Scale Instructions (for all three scales) .....	19
VLSE Scale Items .....	20
VLSE Parallel Form Items.....	20
VLSE Trust Scale Items .....	20
Functional Diversity .....	21
General Diversity .....	22
Generalized Self-Efficacy (GSE).....	22
Leader Trust in the Team.....	23
Organization-Based Self-Esteem .....	24
Self-Rated Leader Performance .....	25
Leader-Rated Team Performance .....	26
Leader Task Complexity.....	27
Work Arrangement .....	28

Leadership Experience.....	28
Virtual Team Characteristics .....	29
Demographic Information.....	30
Debriefing Statement .....	30
Appendix D - Virtual Leader Performance Scale Framework.....	31
Appendix E - VLSE Scale, VLSE Parallel Form, and VLSE Trust Scale Items and Instructions	34
VLSE Scale Instructions (for all three scales) .....	34
Rating Scale .....	34
VLSE Scale Items .....	34
VLSE Parallel Form Items.....	35
VLSE Trust Scale Items .....	35

## List of Tables

Table 1. Results of the third and final EFA. Total variance explained by each of the 6 factors with eigenvalues > 1 for 47 VLSE items. ....	85
Table 2. Pattern Matrix for three-factor solution. ....	85
Table 3. Univariate outliers identified for removal prior to the validation analyses. Z cutoff was >  3.29  and Mahalanobis distance critical value was 24.32 (7 variables, p = .001) .....	86
Table 4. Univariate outliers identified for removal prior to the validation analyses. ....	87
Table 5. Results of the reliability analyses and confirmatory factor analyses for the VLSE scale, the VLSE Parallel Form scale, and the VLSE-Trust scale. ....	87
Table 6. Means, standard deviations, scale reliabilities, and intercorrelations between variables in study 2. ....	1
Table 7. Examination of discriminant validity between OBSE ( $\alpha = .90$ ) and the VLSE scale, the VLSE parallel form, and the VLSE-Trust scale. ....	1
Table 8. Results of hypothesis 9 using 3 regression analyses to test the moderating effect of task complexity on each of the VLSE scales and leader performance. ....	1
Table 9. Results of hypothesis 10 using 3 regression analyses to test the moderating effect of task complexity on each of the VLSE scales and team performance. ....	2
Table 10. Results of hypothesis 11 using 3 regression analyses to test the moderating effect of virtuality on each of the VLSE scales and leader performance. ....	2
Table 11. Results of hypothesis 12 using 3 regression analyses to test the moderating effect of virtuality on each of the VLSE scales and team performance. ....	3

## **Acknowledgements**

The complete list of who to thank and acknowledge is too impractically long to include in its entirety. Dr. Knight, I appreciate every one of our six and a half years working together. Thank you for making it such a joy; you have taught me so, so much. To my family, I thank you for always understanding and supporting my laser-focus that often resulted in my absence (both physically and mentally). To my cohort (the adapted version), please know the laughter we shared and the encouragement you gave has directly and positively impacted my ability to earn this degree. I am thrilled to have so many lifelong friendships to look forward to that all started in our lovely Bluemont Hall. Nathan, I thought you would run out of tolerance for all my endless questions long, long ago. I appreciate your eagerness to always help me grow. And Stacy, you truly carried me through on some of my most dark and despairing days, and I cannot thank you enough for always keeping me grounded and reminding me of the larger picture. Last, Kate, my constant, you know how crucial you were to this process. Thank you for keeping me sane and always believing in me.

## **Dedication**

To the most kind, inspiring, supportive, courageous, hilarious person I know. Hunter, this is for you and truly because of you.

## **Chapter 1 - General Introduction**

Teams are a vital part of almost every organization (Kozlowski & Bell, 2003), and the use of virtual teams in organizations is becoming the norm. Through advancements in computer mediated communication (CMC) technologies (May & Gueldenzoph, 2006), virtual teams allow organizations to leverage distributed knowledge and expertise (Bell & Kozlowski, 2002), meaning experts can be accessed regardless of their location. This boundary-spanning work arrangement allows the most knowledgeable workers to connect over time and distance to work together towards a common objective. Organizations can move more quickly against competition, and virtual team members have the flexibility to work from anywhere (Bell & Kozlowski, 2002). Because of this more frequent use of virtual teams, the roles of organizational leaders are also changing. Current skillsets do not simply translate to leading these teams well though (Dulebohn & Hoch, 2017), and current and future leaders are not confident in their ability to lead via a digital medium (DDI, The Conference Board, & ET, 2018). The role of self-efficacy in leading face-to-face teams is a surprisingly understudied area (Anderson et al., 2008) and no studies to date have explicitly examined the effects of self-efficacy on leading a virtual team. Thus, further examination of the confidence leaders have in their ability to perform the skills necessary to effectively lead a virtual team is an important research endeavor. The present study sought to develop a reliable and valid measure of virtual leader self-efficacy to provide a robust foundation for future research in this area.

### **Virtual Teams**

A virtual team shares many of the characteristics of traditional face-to-face work teams but has a key differentiator. Kozlowski and Ilgen described a team as

“(a) Two or more individuals who; (b) socially interact (face-to-face or, increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are together embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment.” (2006, p. 79)

Essentially, when compared to face-to-face teams, only the method by which virtual teams operate to achieve organizational missions, team goals, and personal tasks is different (Bell & Kozlowski, 2002). Because team members are separated from one another to some degree, a reliance on technology is required to compensate for a lack of face-to-face interaction. Defined more specifically as “groups of geographically and/or organizationally dispersed coworkers (who) are assembled using a combination of telecommunications and information technologies to accomplish an organizational task” (Townsend et al., 1998, p. 17), the use of these teams has far outpaced research on them. In 2017, a large-scale study reported 85% of respondents worked in virtual teams, and teams were culturally diverse too (RW3 CultureWizard, 2016). This does not mean that this many teams are only working solely via technology, as virtuality falls on a spectrum.

### **Virtuality.**

Consensus around the operationalization of virtuality with regard to teams is lacking, to say the least. Scholars agree that most teams are considered to be virtual to some extent (Kirkman, Gibson, & Kim, 2012), and agreement does exist regarding the continuous nature of the variable (Axtell et al., 2004; Bell & Kozlowski, 2002; Hertel et al., 2005; Kirkman & Mathieu, 2005). However, inconsistencies in definitions as well as a lack of comparable

measures or an explicit classification framework has forced recent meta-analyses to use dichotomous coding (face-to-face or virtual teams; (e.g. Breuer et al., 2016; Breuer et al., 2019). Further contributing to this issue, an emphasis on comparing virtual teams to face-to-face teams has resulted in more of a dichotomous treatment of the two variables. Researchers have tested hypotheses based on these dichotomous comparisons rather than on the degree of virtuality, thus hindering alignment in thought (Kirkman, Gibson, & Kim, 2012; e.g. Breuer et al., 2019).

The operational discord largely regards the dimensionality of virtuality. The definition of virtuality appears to have been recreated and reorganized many times in teams research. Even five years ago as many as twenty-nine unique approaches to conceptualizing virtuality had been identified (see Foster et al., 2015 for a review). The authors found a large amount of overlap in the dimensions, with the most utilized being geographic/spatial distance, temporal/time differences, organizational differences, and cultural distance. Some authors have argued that asynchronicity (temporal/time) differences and geographic (spatial) distance are the only two criteria that should differentiate virtual teams from face-to-face teams because the latter can still experience organizational differences and cultural distance in a traditional work environment (Schweitzer & Duxbury, 2010). The same argument could be made in response to those using a technology-usage dimension (e.g. Kirkman & Mathieu, 2005; Maynard et al., 2019) as an identifying feature of virtual teams – since all teams use technology, the use of technology does not dictate team virtuality (Cohen & Gibson, 2003), and neither does the distance between members, as it has been shown that team members make communication media choices independent of distance (Allen, 2007). Rather, it is the lack of face-to-face interaction that defines a virtual team (Kirkman et al., 2002; Fiol & O’Connor, 2005; Schweitzer & Duxbury, 2010). The resulting reliance on technology-mediated communication is a consequence (Bell &

Kozlowski, 2002; Schweitzer & Duxbury, 2010). Even members of the same organization, who work the same hours in the same building, may never choose to meet face-to-face, which would have nothing to do with the distance between them and would need to be compensated for via the use of technology to aid communication. For a team to be considered virtual, it must consist of members who either do not work in the same place or do not work at the same time, and therefore cannot collaborate face-to-face all of the time. Thus, only a lack of face to face interaction is necessary to constitute a virtual team, and this conceptualization was utilized to define virtual teams in this study.

### **Self-Efficacy and Virtual Leadership**

Our current leaders do not feel confident in their abilities to lead virtual teams (DDI, The Conference Board, EY, 2018), and it may be with good reason. Compared to face-to-face teams, virtual leadership requires a fundamentally different skillset (Dulebohn & Hoch, 2017), and many researchers agree that virtual teams are more difficult to lead (Bell & Kozlowski, 2002; Davis & Bryant, 2003; Duarte & Snyder, 2001; Gibson & Cohen, 2003; Hinds & Kiesler, 2002; Hoch & Kozlowski, 2014; Lipnack & Stamps, 2000). This is particularly due to the lack of face-to-face interaction during communication, which is posited to attenuate the influence of a leader (Daft & Lengel, 1986). This lack of confidence is concerning, given self-efficacy's impact on so many fundamental aspects of our lives (e.g. decision making, stress tolerance, achievement; Bandura, 1997).

Self efficacy is a person's belief that they are capable of accomplishing the task at hand (Bandura, 1977) and a vast amount of research has shown the causal impact of self-efficacy on a person's actions. Efficacy is so fundamental in human agency and functioning due to its dual effect on behavior directly and indirectly through goals and aspirations, outcome expectations,

and perceptions of barriers and opportunities in the environment (Bandura, 1997). This powerful determinant of behavior impacts the decision to engage in an activity, the amount of effort expended on the activity, and the tenacity shown when facing obstacles and adversity (Bandura, 1977). Social cognitive theory (Bandura, 1986) regards human functioning as an interaction between behaviors, cognitions, personal factors, and the performance environment. In the domain of leadership, this theory posits that leader cognitions, leader behaviors, and leadership environments must be considered, with the most critical influence for cognitions being a leader's self-efficacy for the leadership task (McCormick, 2001). Studies have shown that self-efficacy for behaviors that are key to virtual team success is more important in virtual teams than in face-to-face teams (Staples & Webster, 2007), and it is possible the same could hold true for virtual leaders. Further, a virtual environment for leadership needs attention, as it has been ignored until recently (Bell & Kozlowski, 2002). This has important implications for leaders who lack the confidence to lead virtual teams.

Surprisingly, there is a dearth of research regarding self-efficacy's effect on leadership. Anderson, Krajewski, Goffin, and Jackson (2008) noted this absence. Although self-efficacy has been shown to be positively related to effective leadership (Paglis & Green, 2002; Prussia, Anderson, & Manz, 1998), and trainings targeting leader self-efficacy have shown success in enhancing transformational leadership effectiveness (Fitzgerald and Schutte, 2010), studies specifically examining self-efficacy towards leading, even in face-to-face teams, are almost non-existent. Instead, the focus is usually on the collective efficacy of the teams, not leader self-efficacy. Further, although virtual team leadership is an (albeit understudied) area of research, the literature addressing the importance of virtual leader self-efficacy is nonexistent. Thus, given the importance of self-efficacy in leadership, and the daunting task of leading virtual teams,

coming to a better understanding of self-efficacy's effect on virtual leadership is an important research endeavor. Unfortunately, prior to this research project, there was no reliable and valid way to measure virtual leader self-efficacy, and this would have hindered further research in this area.

### **Virtual Leader Self-Efficacy (VLSE).**

To allow for a solid foundation of research assessing virtual leadership self-efficacy, a well-developed measurement tool is essential. This study developed a measure that assesses how confident a virtual team leader feels about their ability to perform the necessary behaviors for effectively leading a virtual team. Understanding what the necessary behaviors are first required a firm understanding of what constitutes effective virtual team leadership. This is the focus of the next sections.

## **Responsibilities of Team Leaders**

Just as atoms are the basic units of matter, teams have become the basic units of organizations (Mathieu et al., 2017, 2018, 2019). There is no shortage of leadership models in the team literature that acknowledge the importance of team leaders, yet, very few theories actually specify functional team leader requirements (e.g. Hackman & Walton, 1986; Kozlowski, et al., 1996; McGrath, 1962). There is consensus on the general leadership functions that are necessary though. Assuming these leaders are not responsible for selecting team members or designing tasks, all leader functions can essentially be broken down into two main categories: team development and performance management (Bell & Kozlowski, 2002).

### **Team Development**

First, for developmental duties, a leader is responsible for developing and shaping the team processes; the goal of which is to shape the team into an effective integrated work unit

(Kozlowski et al., 1996a). This mainly includes establishing team coherence and team orientation, which is important for the assimilation and socialization of new team members as well as for the ongoing functioning of established teams. Team orientation serves to affectively connect team members to each other and to the overall mission (Kozlowski et al., 1996a). This motivational alignment includes factors such as emphasizing shared goal commitment, enhancing positive affect, and shaping the climate and culture of the team. Team coherence relies on individuals to have clear role expectations across team members, individual goals that are linked, and team task strategies that can be implemented and depended on. Essentially, this team coherence embodies the interconnections and dependencies that create a collective bond and allows for teams to manage themselves (Kozlowski et al., 1996a; Kozlowski, et al., 1996b, which is crucial in a virtual setting, as elaborated on below.

### **Team Performance Management**

The second category of tasks a leader is responsible for includes all monitoring and management of the team's ongoing performance (Hackman & Walton, 1986, Bell & Kozlowski, 2002). Progress towards task accomplishment must be monitored, and any deviations from the norm must be investigated so effective corrections and guidance can be given to solve problems (Hackman & Walton, 1986). Specific functions a leader typically utilizes when monitoring performance include vigilance, investigative skills such as data-gathering and detecting a team's deficiencies, staying aware of changing external work conditions that could impact projects, and utilizing information in solving problems. When stepping in to prevent or correct performance issues, leaders can anticipate environmental changes and aim to prevent them, aim to create desirable performance conditions, and provide access to resources for the employees (Bell & Kozlowski, 2002; Fleishman et al., 1991; Hackman & Walton, 1986).

## **The Influence of Task Complexity and Team Interdependence**

Before outlining the specifics of effective virtual leadership, it is important to specify the influences of task complexity and team interdependence. There is consensus on the role of task complexity as a constraint for all teams (Bettenhausen, 1991; Goodman, 1986; Guzzo & Shea, 1992; Kozlowski, Gully, Nason, & Smith, 1999; Levine & Moreland, 1990). Due to its criticality in traditional teams, Bell & Kozlowski (2002) identified task complexity as a key theoretical mechanism that must be considered to understand the implications of virtuality for leadership.

The interdependencies among traditional team members vary drastically. Bell and Kozlowski (2002) outlined four interdependence arrangements (pooled/additive, sequential, reciprocal, and intensive) that vary based on task complexity via four dimensions (task environment, external coupling, internal coupling, and workflow interdependence; Thompson, 1967; Vande Ven, Delbecq, & Koenig, 1976). On the most simple end of the continuum, a low-complexity task is categorized as pooled/additive, where work activities are separately conducted, then all team members combine their contribution into the final product. The next simple arrangement is sequential. This refers to tasks that require work to flow from one individual to another unidirectionally over time. Next is reciprocal work, where the work is exchanged between team members back and forth, one by one, over time. Last, the most complex arrangement is an intensive arrangement, where all team members simultaneously work to solve the problem or collaborate on the task. At lower levels of task complexity (pooled/additive and sequential work arrangements), the task environment is static (one step at one time is executed), the external coupling is loose (less time pressure and synchrony requirements; Ancona & Chong, 1997; McGrath, 1991), and the internal coupling is asynchronous and weak (minimal collaboration and information sharing). At higher levels of

task complexity (reciprocal and intensive work arrangements), the opposite is true. These are characterized by dynamic environments requiring more synchronized team processes and timely execution, with higher reliance on information sharing, intrateam processes, and collaboration (Kozlowski et al., 1999). Thus, these task complexity characteristics dictate what style of workflow is needed for the team, which then places demands for the appropriate amount of coordination, communication, and intrateam processes (Kozlowski et al., 1999) to be successful. Although these work arrangements describe face-to-face teams, they hold true for virtual teams as well, with task complexity serving to constrain the characteristics of the virtual team structure and processes (Bell & Kozlowski, 2002). This then directly impacts the necessary leadership requirements for effective virtual team functioning.

### **Discontinuity for Virtual Leaders**

Unfortunately, the conceptualization of key leader responsibilities described above has ultimately assumed that the leader is able to perform these duties through direct interaction with subordinates (Bell & Kozlowski, 2002). For virtual team leaders, the lack of face-to-face interaction with their team results in barriers to the successful execution of these leader functions, as the methods that have worked well in the past with face-to-face teams are not viable options. The knowledge of key virtual leader responsibilities is not easily accessible, either. Over the past decade, numerous scholars have noted the lack of empirical research seeking to better understand the leadership behaviors needed to effectively manage virtual teams (Al-Ani, Horspool, & Bligh, 2011; Bell & Kozlowski, 2002; Hoch & Dulebohn, 2017; Hoegl & Muethel, 2016; Kirkman, Gibson, & Kim, 2012). Great resources exist, however, to guide research in this area. Bell & Kozlowski's (2002) typology of virtual teams provides a theoretical framework and is one of the most highly cited articles regarding virtual teams. These authors elaborate on the

changes necessary for virtual team leadership in immense detail by offering propositions regarding the challenges leaders of virtual teams face. Although not all have been tested, those that have present an empirically based foundation to build upon, namely the sharing of leadership duties and the addition of structural supports. When paired with an extensive literature review of academic and practitioner articles, the essence of effective virtual leadership begins to emerge.

### **The Influence of Virtuality**

Task complexity is not the only factor affecting virtual leader behavior, however, as the degree of virtuality that characterizes the team also impacts the leadership role. If a team meets face-to-face for 75% of the time (25% virtual) and works together at the same time (low asynchronicity / temporal distribution), leaders will not have to change their behaviors much because they still have face-to-face interactions. However, as a team's asynchronicity increases and members of the team work at different times of the day, their geographic dispersion and their reliance on technology for all interactions is increased as well, and the team is considered to be higher on virtuality (e.g. 75% virtual, 25% face-to-face). This places constraints on the virtual team leader's ability to perform their key leadership functions of team development and performance management (Bell & Kozlowski, 2002), as described in detail below. Essentially, the more a virtual team resembles a high-complexity intensive work arrangement and the more virtual the team is, the more deviations from face-to-face leadership will be needed (Bell & Kozlowski, 2002). The goal of the present study was to capture the behaviors needed to successfully lead a highly virtual team that works on complex tasks with an intensive work arrangement, thus allowing for a virtual leader's self-efficacy for effectively leading a virtual team to be assessed.

## **Pillars of Effective Virtual Leadership**

Our fundamental understanding of leadership is challenged when face-to-face contact with followers is restricted. A quick Google search for virtual jobs will result in a laundry list of sites dedicated to helping workers find their desired job and desired level of virtuality. It is important to determine how to effectively lead these employees so leaders can feel confident doing so. Some have said organizations have an ethical obligation to train their employees in ways that protect them from obsolescence due to advancements in technology (Kozlowski & Hults, 1987), and stagnant, outdated leadership skills used in a tech-dominated world should be no different.

The two constraints – task complexity and virtuality – ultimately create a world where traditional leadership is not effective. Improper management of virtual teams has led to a sad success rate of 50% (Kanawattanachai & Yoo, 2002), but there is opportunity for growth and improvement that can be guided by what we have learned over the last two decades. To unearth the relevant research, scholarly databases such as Google Scholar, Proquest, and PsychInfo were searched for key words, including “virtual teams” and “distributed teams,” with an emphasis on articles examining team effectiveness. The search was expansive due to the desire to gain a multidisciplinary perspective, rather than solely examine articles published in psychological journals. When articles were found that covered exactly the topic of interest, references were searched for other relevant articles to ensure thoroughness. Excluding Google Scholar, databases returned a total of 381 articles. Google Scholar searches were more difficult to narrow, thus resulting in 554 articles. In sum, 935 articles were examined. After specifying peer reviewed sources only (this option was not available in Google Scholar), the number of articles dropped to 748. Articles needed to focus specifically on virtual leader effectiveness for virtual teams, not

individual performance, thus 691 articles were eliminated, leaving 56 articles for further examination. The information in these articles was spliced into over 130 specific findings to aid in organization. For example, if a metaanalysis was used, it was separated by key take-aways rather than categorized wholly to add more granular detail. Additionally, if an article had relevant findings about both communication and shared leadership, these were separated and categorized with those labels rather than choosing which category it should go into. All information was categorized based on Bell & Kozlowski's (2002) developing and managing themes. Then, each theme was further subcategorized based on similarities in content by going through each piece of information multiple times to ensure appropriate labeling.

Three main take-aways from the review provide perspective prior to diving in. First, it cannot be overstated how vital trust is in a virtual team. Unfortunately, the virtual environment makes building trust very difficult (Hacker et al., 2019). Every interaction (and every key behavior) either builds or breaks trust. This leads into the second point; communication is the vehicle through which all good and bad interactions occur in virtual teams. Structures and expectations must be put in place to minimize poor communication (thus reducing risk to trust levels; Hoch & Kozlowski, 2014). Third, empowering employees to take control of their tasks and communicate amongst themselves is extremely important for accountability and success. Shared leadership provides the opportunity for this (Hoch & Kozlowski, 2014), which is highly dependent on trust and good communication (Drescher et al., 2014). Though these are not the only findings, they help set the scene as key virtual leader behaviors are described next.

## **Communication**

In any team, communication is absolutely necessary for both leaders and team members; the unit cannot function without it. Over and over again, communication has been identified as a

crucial factor for successful team performance (Espevik, Johnsen, Eid, & Thayer, 2006; Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006). Often defined in a variety of ways (Stout, Cannon-Bowers, & Salas, 1994), researchers agree that team communication is essentially any messages that are exchanged between two or more team members (Adams, 2007). This integral process has been found to enhance team performance via the facilitation of other crucial emergent processes and outcomes, such as coordination and team monitoring (Espevik et al., 2006; Gibson, 2001; Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006). Communication provides the opportunities to enhance all factors that make a team more effective. Due to a lack of face-to-face interaction, high-quality communication is the only pathway available for virtual leaders to interact with their followers, enact shared leadership, and build trust. Virtual leaders must find ways to compensate in an environment in which they are lacking the benefits of face-to-face communication.

**Virtual leaders need to facilitate the development of high-quality team communication standards.**

One method shown to compensate for lower influence in a virtual environment involves explicitly influencing expectations regarding how the team should communicate. High-quality communication means better virtual team performance (Chang et al., 2011). The addition of team communication standardization to create structured processes has been shown to enhance comprehension of messages, thus reducing the amount of time it takes to respond and move forward with objectives (Dube & Robey, 2009). Enhancing structure also helps to enhance work predictability, which is very important for virtual teams to work effectively (Chudoba et al., 2005). This is mainly because creating more familiarity and predictability removes barriers to trust (Hacker et al., 2019). These standardization aids come in a variety of forms and should be

customized to what all members agree upon. For example, shared team calendars allow impromptu meetings to be scheduled more effectively, and detailed work plans cut down on duplication of effort. By providing predictable communication opportunities, where team members know they can rely on sending and receiving timely communication, perceptions of trust are enhanced among team members and effectiveness is increased (Duckworth, 2008). Further, written communication norms and guidelines establish shared expectations, which can also contribute to shared leadership, as elaborated on below. Establishing etiquette can aid in enhancing communication. More specifically, encouraging wording clarity (e.g. no slang or colloquialisms that others might not understand), as well as establishing expectations on predictable time frames for communication paired with techniques such as ‘parroting’ (e.g. 24-hours to explicitly acknowledge that I read and understand your email) can drastically enhance team comprehension of messages (Dube & Robey, 2009; Duckworth, 2008; Marlow, Lacerenza, & Salas, 2017; Montoya et al., 2009). The focus should be on quality of communication, not quantity, as some teams perform well without a high frequency of communication (Desanctis & Monge, 1998; Espevik et al., 2006). Closed-loop, high quality, timely communication is the goal (Mesmer-Magnus & DeChurch, 2009; Marlow, Lacerenza, & Salas, 2017), as it builds trust and enhances team effectiveness. All members should be trained on these standards to ensure adherence, and all members should have access to the communication modes that are decided upon (Dube & Robey, 2009; Ford et al., 2016). Leaders need to be capable of identifying what communication standardization structures are most needed in their team. These guidelines and protocols should be developed with large amounts of team input to enhance buy-in. The leader also is responsible for implementing these standards uniformly and adhering to them as well.

**Virtual leaders need digital fluency to exercise good judgement when selecting the appropriate mode of communication to match the type of messages.**

Even specifying when certain modes of communication should be utilized is prudent, as effective leadership is constrained by the capabilities of whatever communication media is used (Kayworth & Leidner, 2002). Different types of messages call for different communication modes, and a leader must be digitally fluent, also known as media savvy, where they are considered proficient in utilizing the appropriate communication media in the right situation (Norman et al., 2019). For example, when teams are engaging in conveyance tasks where they are just exchanging information that is low urgency and not time sensitive, team members feel that asynchronous electronic communication media (AECM) tools like chat, listervs, and email are adequate (Normal et al., 2019). However, teams strongly prefer synchronous communication (face-to-face, or if impossible, video calls) when they are performing convergence tasks that develop shared meaning for projects (kickoff and closeout meetings or if time sensitivity is an issue; Davison et al., 2006; Mattarelli & Tagliaventi, 2010; Montoya et al., 2009; Norman et al., 2019). This synchronous preference especially extends to situations where emotions and sensitivity may be high, such as when discussing performance appraisals and addressing conflict (Davison et al., 2006; Norman et al., 2019). For example, using email to publicly criticize mistakes can harm team performance and relationships (Cousins, Robey, & Zigurs, 2007). Additionally, leaders need to be aware of how often they are reaching out to their team members. Leaders taking time to build relationships with their team members by keeping regular contact with them can reduce feelings of isolation that come with being a virtual team member. This can enhance team cohesion, satisfaction, and motivation (Kirkman et al., 2002). Thus, it is crucial that the leader exercise good judgement about which communication method to use and when to use

it, as it can have repercussions that harm trust and cohesion when incorrect choices are made (Hacker et al., 2019).

## **Trust**

When people depend on each other to accomplish goals, as leaders and followers do at work, trust becomes vital for effectiveness (Brahm & Kunze, 2012; Mayer et al., 1995). It has been described as the “glue of the global workspace” (O’Hara-Devereaux & Johansen, 1994, p. 243), and this view is globally accepted (Oertig & Buergi, 2006). This dependency is even more true in virtual teams (Breuer et al., 2016). Trust is defined in a variety of ways but most conceptualizations have two key points; a positive expectation that another party will treat you favorably, and a willingness to be vulnerable to others (Mayer et al., 1995; Colquitt et al., 2007; Breuer et al., 2019). In a team setting, the definition holds those same fundamental elements, but contains more context. Team trust is defined as

“the shared willingness of the team members to be vulnerable to the actions of the other team members based on the shared expectation that the other team members will perform particular actions that are important to the team, irrespective of the ability to monitor or control the other team members.” (Breuer et al., 2019, p. 3).

Trust in virtual and face-to-face teams has been tied to positive organization outcomes that benefit both the organization (commitment, OCBs, performance) and the employee (satisfaction, morale; Brahm & Kunze, 2012; Breuer et al., 2016; Brown et al., 2015; Chang, Chuang, & Chao, 2011; Costa, 2003; DeRosa et al., 2004; Jarvenpaa et al., 2004; Joshi et al., 2009; Li et al., 2012; Liu et al., 2008). It is foundational to the effective functioning of virtual teams (Jarvenpaa, Knoll, & Leidner, 1998; Verburg et al., 2013, Hacker et al., 2019) as it improves collaboration and knowledge sharing (Al- Ani et al., 2013; Henttonen & Blomqvist,

2005; Jimenez et al., 2017), cohesion, virtual team coordination, performance, communication, and learning effectiveness, and reduces psychological distance and turnover intentions (Alisharo, Gregg, & Ramirez, 2017; DeRosa et al., 2004; Edwards & Sridhar, 2005; Joshi et al., 2009; Jarvenpaa et al., 2004; Jarvenpaa and Leidner, 1999; Lukić & Vračar, 2018; Sarker et al., 2011). Additionally, virtual team members who trust each other also give each other the benefit of the doubt when technology malfunctions (Gaan, 2012), which is important because virtual team members tend to assume the worst if an explanation is lacking (Cramton, 2001). Unfortunately, trust-development is hindered in virtual teams due to the lack of face-to-face interaction (Hacker et al., 2019, McDonough, Kahn, & Barczak, 2001) as relationship-building is much more difficult (Powell, Piccoli, & Ives, 2004). Thus, a key virtual team leader responsibility is to create, reinforce, and maintain trust within the team and between themselves and each team member (Al- Ani, Marczak, et al., 2013; Hacker et al., 2019; Hambley et al., 2007; Henttonen & Blomqvist, 2005; Hertel, Geister, & Konradt, 2005; Joshi et al., 2009; Liao, 2017; Lukić & Vračar, 2018; Thomas & Bostrom, 2008; Zander, Zettinig, & Mäkelä, 2013).

**Virtual leaders must be worthy of trust, and leaders must be capable of building trust in their team virtually.**

Trusting in the virtual team leader positively impacts virtual team effectiveness, and leader behavioral characteristics influence this trust (Flavian, Guinalú, & Jordan, 2019). First and foremost, virtual team members trust leaders who are skilled at using technology. If a leader is not technologically proficient, this becomes a barrier to trust (Norman et al., 2019) and will then negatively affect all interaction occurring via a computer, which could be all of them. Digital fluency (choosing the appropriate mode of communication depending on the message), as mentioned previously, also impacts leader trustworthiness (Hacker et al., 2019). To build trust,

leaders should be explicitly fair and transparent in their actions, and they should exercise empathy with their team members (Flavian et al., 2019; Ford et al., 2016). One benefit of virtual communication is that the vast majority can be easily documented, which can provide team members with reassurance and a means of accountability when guarantees are made (Norman et al., 2019) and it also enhances transparency (Breuer et al., 2019).

In contrast to face-to-face teams, trustworthiness in a virtual team has much more to do with consistent performance than social bonds (Kirkman et al., 2002; Kanawattanachai & Yoo, 2002). For example, the suggestions outlined above regarding communication norms and guidelines help to build trust because they help teammates respond in a more timely, comprehensive, high-quality manner (Jarvenpaa & Leidner, 1999; Kirkman et al., 2002), thus allowing consistent performance to be more attainable since expectations are so explicit. Timeliness of communication is very important and teammates should understand that the longer they take to reply, the more negativity is felt by the sender, which impacts trust. A response as simple as following up to inform the recipient did get the message is adequate to mitigating these negative emotions (e.g. the parroting technique; Jarvenpaa, Shaw, & Staples, 2004). Trust takes time to build (Hacker et al., 2019) with some estimates ranging from three to nine months (Oertig & Buergi, 2006). Unfortunately, before behavioral information is available, initial trust beliefs rely heavily on the person's predisposition to trust (Jarvenpaa et al. 1998, Mayer and Davis 1999, Mayer et al. 1995, Robert et al. 2009), thus, providing opportunities for the team to become more aware of what other team members are working on and other contextual details about their workload can aim to provide more behavioral data to influence trust (Dabbish & Kraut, 2008; Dennis et al., 2012; Alsharo, Gregg, & Ramirez, 2017). Social interaction is still important for building trust, though it is not the foundation for virtual trust. It takes more effort

to build social relationships virtually, and informal, regular communication can help, especially if a less formal writing style (“Hi Dan!” vs “Dear Sir,”) and non-task related communications (jokes, weather, sports, hobbies) are included in task-related messages. When teams communicate and socialize face-to-face at the beginning of a team’s formation, it also makes it easier to build trust (Hacker et al., 2019) and enhances performance too (Chudoba et al., 2005; Horwitz, Bravinton, & Silvis, 2006).

Mutual trust is needed in virtual teams (Bell & Kozlowski, 2002; Norman et al., 2019; Gilson et al., 2015). This creates a safe environment where people do not fear that someone may take advantage of them (Robert, Denis, & Hung, 2009). Psychological safety via a safe, open, and communicative climate is important as it can mitigate the negative effects of geographic dispersion in virtual teams (Gibson & Gibbs, 2006). Mutual trust is needed for this, and team members have identified characteristics that influence their willing to trust leaders, as well as their own trustworthiness. They trust those who have the ability to perform their jobs, have integrity and show benevolence towards them, have high-quality communication skills, and are predictable and transparent in what they do and say (Breuer et al., 2019; Mayer et al., 1995, McAllister, 1995, Norman et al., 2019). Those same team members also recognize that they must be deemed trustworthy by their leaders for trust to develop, and those same characteristics influence this (Norman et al., 2019). Leaders can facilitate trust building by helping the team share more information about their ability, benevolence, predictability, integrity, and transparency, and they can share this about themselves too to help their trustworthiness (Breuer et al., 2019). Larger team sizes make building trust more difficult (Hacker et al., 2019), which could be because of the larger amount of effort it would take to familiarize everyone with each

other. Further, conflict destroys trust, so leaders should aim to prevent and address conflict in a timely and transparent manner (Hacker et al., 2019).

Timing also impacts trust, and digital fluency can aid in maximizing early opportunities. Facilitating informal team building and knowledge sharing activities with synchronous communication modes (face-to-face or videoconferencing) in the early stages of a team's life is instrumental to building trust amongst team members, as the additional visual and vocal cues aid in this relationship building (Maruping & Agarwal, 2004; Dube & Robey, 2009). Informal communication that helps members to socialize builds trust amongst team members and improves performance as well (Chudoba et al., 2005; Curşeu et al., 2008; Horwitz, Bravington, & Silvis, 2006; Dube & Robey, 2009; Hacker et al., 2019; Kaisa & Kirsimarja, 2005).

**Virtual leaders need to be capable of maximizing predictability and reducing uncertainty wherever possible.**

Predictability and familiarity aid in building trust in virtual teams (Jarvenpaa et al, 1999; Breuer et al., 2019; Chudoba et al., 2005), and any sort of diversity and variety that is not the norm, whether it be in the form of cultural distance (language, demographic, and cultural diversity) or functional diversity (which encompasses differences in team member jobs), results in strong barriers to trust (Al-Ani, Marczak, et al., 2013; Al-Ani & Redmiles, 2009; Gaan, 2012; Krebs et al., 2006; Newell et al., 2007; Paul & He, 2012; Hacker et al., 2019; Aubert & Kelsey, 2003; Li et al., 2012). Fortunately, there are actions that can be taken to mitigate these negative effects that stem from encountering things that are outside of a team members' realm of understanding. For cultural diversity, which was predicted as an obstacle to effective team functioning by Bell & Kozlowski (2002), these barriers largely have to do with conflicting expectations and norms regarding how to handle interactions, leadership, decision making, and

other factors (Scott, 2013). Bell and Kozlowski (2002) proposed that a culture built on “mutual respect, trust, and obligation between members at all levels” (p. 38) would be a promising solution to this issue, and their predictions are quite spot on based on the following and preceding information regarding trust. The outgrowth of this empowering culture is team cohesion, which, as mentioned earlier, is a key developmental leadership function for virtual leaders. Importantly, trust is linked to increased virtual team cohesion (Brahm & Kunze, 2012; Jarvenpaa et al., 2004; Kuo & Yu, 2009; McNab et al., 2012) and lower turnover (DeRosa et al., 2004). Fortunately, leaders are capable of enhancing their team’s cultural understanding and adaptation, which can help build trust despite these differences (Dorairaj et al., 2012; Chang, Chuang, & Chao, 2011). Communication quality and performance is also enhanced in virtual teams with greater cultural adaptation (Chang, Chuang, & Chao, 2011). To mitigate the negative effects of having a variety of subject matter experts on your team (functional diversity), members need to gain knowledge about team members’ expertise (Aubert & Kelsey, 2003; Li et al., 2012). Effective methods are knowledge sharing activities revolving around sharing technical knowledge and having a document outlining each team members area of competence to enhance trust and collaboration (Alsharo, Gregg, & Ramirez, 2017; Dorairaj & Noble, 2013). Virtual team leaders can also strengthen trust through mitigating social ambiguity too. This can be done by proactively communicating information about each team member to everyone else (Joshi, Lazarova, & Liao, 2009). By providing missing social and performance information that would traditionally be available in a face-to-face environment, leaders can help to develop beliefs about the credibility, competency, and ability of others to enhance trust (Hacker et al., 2019; Kanawattanachai & Yoo, 2007; Lawley, 2006).

Another important area to mitigate ambiguity and enhance predictability is the employee's role in the team. Well-defined roles are extremely important in virtual teams (Al-ani, et al., 2013), and understanding other team members roles and their areas of expertise is crucial. Enhancing work predictability is very important for virtual teams to work effectively (Chudoba et al., 2005). This is mainly because creating more familiarity and predictability removes barriers to trust (Hacker et al., 2019). To enhance effectiveness, virtual team members need to have an extremely clear understanding of their own role and responsibilities as well as other team members' too so that all tasks can be accounted for (Lee-Kelley & Sankey, 2008). This includes a clear understanding of what the team and individual goals are, what their role is in those goals, and a common understanding of the tasks being taken on (Zimmerman, Wit, & Gill, 2008). When all this information is known it allows the team to have autonomy over where they direct and coordinate their efforts (Hacker et al., 2019) which is necessary for highly interdependent teams to successfully operate. This autonomy for interaction and understanding of roles also allows members to evaluate other's performance based on their interactions with them, which builds behavioral-based trust beliefs (Hacker et al., 2019; Kaisa & Kirsimarja, 2005), which are especially relevant for virtual teams as studies have shown this ability-based trust is built from team members observing each other directly (Aubert & Kelsey, 2003; Mayer et al., 1995). Enhancing goal clarity and aligning goals as a team also results in performance and satisfaction increases (Stark & Bierly, 2009; Duckworth, 2008). By setting the team up for task autonomy via clear roles and goals, the team can be empowered to fill leadership gaps that result from virtuality via shared leadership.

## **Shared Leadership**

Bell and Kozlowski (2002) wrote extensively about the inability for leaders to do it all alone. They felt that substitutes for leadership (referred to as structural supports) and distribution of leader functions would be necessary when face-to-face contact was limited. The effects of hierarchical leadership are diminished in virtual team, and the style is less effective for enhancing performance (Hoch & Kozlowski, 2014). Further, it is also known that leaders change their styles in unpredictable ways depending on the context (Purvanova & Bono, 2009), which is problematic in this new virtual world leaders are expected to live in. Additionally, given the inability for virtual leaders to visibly monitor their team's performance, a system needs to be put into place that allows the team to regulate and monitor their own performance (Kozlowski et al., 1996). As mentioned in the section above, clear direction and specific, linked individual goals are crucial to this point because they enhance each team member's self-regulation and enable the team to collectively monitor their performance as well as get feedback (Bell & Kozlowski, 2002; Kozlowski, 1998; Smith et al., 1997). This does not mean that the team is left to its own devices. Rather, systems and structures need to be put into place that allow good team performance patterns to become a habit. For example, the standard operating procedure that results from developing team communication standards mentioned above is an example of a structural support that can create a more positive performance routine (Bell & Kozlowski, 2002).

Shared leadership stems from the idea that leadership functions do not need to be a single individual's responsibility (Locke, 2003; Pearce & Conger, 2003). It is a phenomena that forms within teams over time (Contractor et al., 2012) and has been described as "an emergent property of a group where leadership functions are distributed among group members" (Drescher et al., 2014, p 2). More specifically, it is defined as "a dynamic, interactive influence process among

individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals” (Pearce & Conger, 2003, p. 1). By providing the context needed to enable team members to take control of their own tasks, it serves to break down communication barriers that virtual teams face (Bell & Kozlowski, 2002; Pearce, 2004). This is especially important at higher levels of task complexity and interdependence (Kirkman et al., 2004; Nicolaidis et al., 2014; Wang et al., 2014). Shared leadership has been shown to enhance virtual team performance (Hoch et al., 2010; Muethel et al., 2012; Carson et al., 2007; Pearce & Sims, 2002; Kirkman et al., 2004) over and above vertical leadership (Nicolaidis et al., 2014; Wang et al., 2014) and it also enhances performance in face-to-face teams too (Hoch & Kozlowski, 2014; Kirkman et al., 2004; Hoch & Dulebohn, 2013; Hoch & Wegge, 2014). A good shared leadership system builds trust, and enhances the team processes (e.g. team confidence, trust, cohesion) that have a great impact on increasing performance and other employee outcomes like satisfaction (Nicolaidis et al., 2014; Wang et al., 2014; Robert & You, 2013; Drescher et al., 2014).

**Effective virtual leaders need to create an environment where shared leadership can develop.**

Virtual leaders have shown a tendency to underestimate their team’s ability to lead themselves (Hoegl & Muethel, 2016). This leads to problematic hoarding of decision-making authority and micromanagement of the team; it is the leaders themselves that are hindering virtual team performance when they do this (Hoegl & Muethel, 2016). Virtual team members are typically chosen to be on virtual teams because they are experts in their niche (Bell & Kozlowski, 2002). These teams need to be given autonomy and decision-making authority so that when they recognize an opportunity to take action, or a virtual collaboration challenge that needs addressed, they feel they have the latitude to do so (Hill & Bartol, 2016). Shared

leadership is essentially task leadership. It is important to recognize the strong link between shared leadership and trust. Trust mediates the relationship between shared leadership and virtual team performance (Drescher et al., 2014), which highlights the cruciality of building it in virtual teams. In a way, it is the foundation that allows shared leadership to be built. If a leader does not trust their team, they are not going to give them the autonomy they need to act. If a team member does not trust other team members, collaboration will not be effective or efficient.

Hoch and Wegge (2014) characterized shared leadership as consisting of affective, cognitive, and behavioral leadership components. For affective shared leadership, the goal is to create a sense of belonging in the team, by increasing awareness and collective identification with the team, as well as enhancing aspects of organizational support. Leaders can enhance team identification by accommodating individual differences, giving constructive positive feedback, organizing teambuilding activities, and emphasizing the shared common goals, values, and visions of the team, which should be aligned (Sivunen, 2006; Mattarelli & Tagliaventi, 2010; Holton, 2001; Duckworth, 2008). This can make addressing conflict easier because it has helped to establish stronger interpersonal bonds among team members (Siebdrat et al., 2009). For cognitive shared leadership, the goal is to get everyone to think like a team (Hoch & Wegge, 2014). By placing heavy emphasis on task and goal clarity, as well as highlighting task interdependence among the team members, virtual leaders are able to enhance opportunities for shared cognitive leadership. Encouraging active searches for feedback and errors and facilitating after event reviews can build the shared mental models of the team. Early and frequent communications about tasks, and directories of team member expertise can also aid in developing transactive memory systems to promote team thinking (Kanawattanachai & Yoo, 2007). Shared behavioral leadership emphasizes that the team must act together as a unit. This is

where structural supports and team processes that help to guide the group's behavior come into play. Studies have shown that effective emergent shared leadership behaviors involve a dual focus on individual production behavior and shared monitoring behavior (Carte et al., 2006). The former is characterized by a member stepping up to lead the group by utilizing their specific skillset and area of expertise that is relevant to the task at hand. The latter involves all members coordinating their activities and keeping track of deliverables to move the group forward. Carte, Chidambaram, and Becker (2006, p. 340) summed it up well when they said, "good performance appears contingent upon members displaying two types of leadership: contributing their individual expertise to the group and being a team player". Establishing these behaviors early in the team's formation may lead to the best success. Leaders need to create an environment that supports and encourages this distributed collaboration (Bell & Kozlowski, 2002; Hill & Bartol, 2016), especially for teams that are highly virtual and highly interdependent (Hill & Bartol, 2016; Wang et al., 2014). With the addition of structural supports, which are discussed below, these teams can become adept at acting as a unit. Interestingly, studies have shown that women are more effective at shared leadership than men (Muethel et al., 2012), and that charismatic and transformational shared leadership styles might be more effective in virtual teams than sharing traditional styles of leadership (Wang et al., 2014; Purvanova & Bono, 2009; Joshi et al., 2009). Structural supports are needed to fully maximize shared leadership in virtual teams, though.

**Virtual leaders need to identify and implement appropriate structural supports to enhance team functioning.**

The idea of structural supports comes from the leadership substitutes approach, which asserts that task and organizational features can compensate for, enhance, or neutralize the

effects of leadership on employee behavior (Kerr & Jermier, 1978; Hoch & Kozlowski, 2014). These supports act as an indirect form of influence for team motivation and behavior (Bell & Kozlowski, 2002). Bell & Kozlowski (2002) suggested virtual leaders create structures and routines to act as a supplement for virtual team leaders by regulating team behavior, and evidence shows these are effective at enhancing performance (Hoch & Kozlowski, 2014). Structural supports help virtual teams through the stability and reduction of ambiguity they provide. Structured and unified processes that support virtual team effectiveness are needed because team members, especially when scattered across the globe, have different work practices, and this can lead to inefficiency, misalignment, and misunderstandings. Process conflict is more detrimental to virtual teams than face-to-face teams (Bierly et al., 2009; Hacker et al., 2019), thus, creating efficient team processes is advisable.

A major component of structural supports for virtual teams is communication and information management. As mentioned previously, the communication guidelines fall in this category and are a great example of this structural support mechanism. By building and managing these systems that “facilitate connectivity, remove perceptions of distance, and facilitate the organization and accessibility of information”, leaders “can reduce feelings of lack of trust, anonymity, de-individuation, and perceptions of low social control” (Hoch & Kozlowski, 2014, p. 393). This also extends deeper into how to handle teamwork. By having a common, agreed upon way to handle team processes, it can enhance familiarity and a member’s understanding of how they fit into the team, as well as reduce perceptions of distance (Duckworth, 2008; Lee-Kelley & Sankey, 2008; Mattarelli & Tagliaventi, 2010). These high-quality team planning processes that help to guide team accomplishments and coordinate effort have been shown to enhance performance (Rapp, et al., 2010; Snow et al., 1996; Siebdrat, et al.,

2009). Another important structural support comes in the form of a performance appraisal system that properly rewards virtual teamwork (Hoch & Kozlowski, 2014; Snow et al., 1996; Ford et al., 2016). Leaders should be aware if their team members are being rewarded for the appropriate efforts. Thus, customized structural supports are a valuable key to virtual team success.

**Virtual leaders need to be able to determine how virtual their team is and how interdependent the team's tasks are to allow for a customized leadership approach.**

Almost every single piece of evidence for effective leadership comes with the caveat that the needs of a virtual team require more drastic leadership changes the more virtual it is. The same goes for the complexity and interdependence of the team's tasks. A leader must be capable of determining the level of virtuality their team is at, and how interdependent the team members are based on their tasks. Without this knowledge, the leader will fail to implement the correct structures, processes, and behaviors. To understand the implications of virtuality for their team, they must be well-acquainted with what they are dealing with. Ultimately, virtual team leaders have to sacrifice control over their management functions via shared leadership and structural supports so that instead, they can focus on developing their team's cohesion, trust, communication, and collaboration. Their main responsibility is to create a trusting environment where members can communicate openly and where shared leadership can thrive.

### **Virtual Leader Self-Efficacy Dimensions**

Based on the literature review, virtual leaders need to 1) facilitate the development of high-quality team communication standards. They need 2) digital fluency to exercise good judgement when selecting the appropriate mode of communication to match the type of messages. They must be 3) worthy of trust, and leaders must be capable of building trust in their team virtually. Virtual leaders need to 4) be capable of maximizing predictability and reducing

uncertainty wherever possible, and in this they must maximize role, task, and goal clarity. Effective virtual leaders need to 5) create an environment where shared leadership can develop, and they need to 6) identify and implement appropriate structural supports to enhance team functioning. Last, virtual leaders need to be able to 7) determine how virtual their team is and how interdependent the team's tasks are to allow for a customized leadership approach. These seven areas of focus served to inform the dimensionality of the scale.

*Hypothesis 1: The VLSE scale will have 7 dimensions corresponding to the seven key virtual leader behaviors.*

In proper survey development, a multi-phase approach is necessary. During the scale development phase, the measure is designed and then must be tested in a group of pilot participants (Thorndike, 2005). The second phase then serves to validate the scale via the development of a nomological network of theoretical relationships with existing constructs. This step is vital in showing that the scale is measuring what it should be measuring (Campbell & Fiske, 1959; Hinkin, 1995; Messick, 1995). Thus, in Phase I, the development of the scale, the procedure for the first wave of data collection, and the assessment of the scale's psychometric properties is described. In Phase II, the scale's test-retest reliability is reported, the factor structure found in Phase I is confirmed, and the scale is validated by examining the hypothesized relationships.

## **Chapter 2 - Phase I: Scale Development**

Scale development techniques recommended by DeVellis (2017) and Hinkin (1998) were utilized to guide construction. The seven key virtual leader behaviors that were gleaned from the thorough literature review above informed the item generation, as their definitions served as a guide (Schwab, 1980). Social cognitive theory (Bandura, 1986) additionally served as a

theoretical framework to guide item development. Utmost importance was placed on Bandura's (2006) guidelines for constructing self-efficacy scales. More specifically, the scale focuses on the individual's belief in their ability to succeed at a given task (Bandura, 2006). In this scale, self-efficacy is viewed as a belief system that is able to be developed, not as a generalized trait, which is a common mistake in the measurement of self-efficacy (Bandura, 2012). A first step in developing a valid self-efficacy scale involves clearly specifying what high performance in that given domain looks like, including barriers to achieving that level of performance. The previous section identifying key virtual leader behaviors and barriers to successful virtual leadership provided that clarity.

### **Item Generation Process**

Items were specifically written to tap into the seven key virtual leader behaviors described above. For each category, between 15 and 30 items were written. This resulted in an initial list of 160 items. Next, to provide evidence of content adequacy (Schriesheim et al., 1993) seven subject matter experts (SMEs) examined the items for clarity, quality, and content. Specifically, in an online survey, SMEs were instructed to sort each item into the dimension they think is best described by the item. Ratings of content adequacy were gathered as well. Although a minimum of 75% has been identified as an acceptable agreement index (Hinkin 1998), with only seven SMEs total, it was determined that five out of seven must reach agreement (71% agreement) rather than six out of seven (86% agreement).

Fifty items were removed due to unacceptable SME agreement. Some dimensions were left with smaller item numbers, thus, 20 more items were written to imitate the sentence structure and content of those that did receive high consensus among SMEs. The same survey procedure and agreement cutoff was utilized, and again seven SMEs provided responses, resulting in the

removal of four items. Thus, a total of 126 items were deemed adequate for distribution. Specific instructions and scaling are described below.

## **Study 1 Method**

### **Sample and Procedure**

A total of 270 participants completed an online survey that was distributed via Qualtrics, an online participant platform. Participants were paid \$13 for their anonymous participation, a rate determined by Qualtrics that accounts for the length of the survey and the accessibility of the intended sample. All participants were required to be managers or hold higher titles. These participants will be referred to as leaders moving forward. To take the survey, they needed to be responsible for a team, which was described as at least two or more employees who work together. Leaders responsible for a variety of individuals who do not work together in any way were excluded from participation, as they are not managing teams. Additionally, the leaders needed to utilize telecommunication technology during their workday to some extent. No specifications were made on how virtual the team must be, but the leaders did have to indicate that they or their team works virtually at least part of the time.

Although Qualtrics employs attention checks throughout the survey, responses were examined for quality. In total, 11 participants were excluded. Five incomplete responses were removed, and six responses were removed due to concerns about their understanding of the scale. More specifically, their responses to a calibration question (discussed below) were assessed, which instructed the participant to rate their self-efficacy for lifting increasingly heavier weights. In general, these participants were more confident that they could lift 3,600 pounds compared to much lighter weights. This indicated the participant did not understand how to use the VLSE

response scale, thus their responses were likely nonsensical and misrepresentative of their confidence in themselves. Thus, 259 participants were included in the analysis.

### **Sample Characteristics**

The sample consisted of more than twice as many males ( $n = 180, 69.5\%$ ) as females ( $n = 79, 30.5\%$ ). The vast majority of participant employment status was full time (96.5%), with a few participants endorsing “other” ( $n = 2$ ) or reporting unemployment ( $n = 2$ ). Since full-time status was not a requirement, it was deemed acceptable to keep the unemployed participants, as they both passed all other screening questions, and one appeared to be retired. Participants also reported their highest level of completed education. The sample was highly educated, with 86.5% holding either a Bachelor’s (47.5%), Master’s (31.3%), Doctoral (4.2%), or Professional degree (3.5%). The remaining 13.5% consisted mainly of participants with an Associate degree (6.9%) or some college but no degree (5%). Three participants were high school graduates, and one did not complete high school. The sample predominantly consisted of participants identifying as Caucasian/White (77.6%) with some representativeness for African American/Black (4.6%), Asian/Pacific Islander (9.7%), and Hispanic/Latino/Latina (5.4%). One participant was Middle Eastern, four were Native American, one endorsed “other”, and one preferred not to say. A wide variety of industries were also represented, with about 60% of respondents working in banking (4.6%), consulting (5.4%) education (7.3%), financial services (5%), health (9.3%), manufacturing (10.4%), retail (5.4%), and technology (4.6%). There were 8.5% who endorsed “other” as their industry, and 3.5% worked for the government. Construction (2.7%), insurance (2.7%), real estate (2.7%), and transportation (2.7%) made up almost 11% of the total as well. The remaining 20.7% consisted of small percentages of respondents ( $< 2\%$ ) from 28 different industries.

## Measures

The survey consisted of the VLSE scale and a variety of demographic information. All materials presented to participants can be found in Appendix B. Participants first agreed to an informed consent form. Next, participants were provided with an explanation of why they were chosen for the study. Specifically, the paragraph provided a description of what a virtual team is and what forms they might take. Then participants were instructed to please answer the questions relative to leading virtual teams rather than strictly face-to-face teams.

As recommended by Bandura's (2006) scale development guidelines, a practice calibration item was displayed next to familiarize the participant with the VLSE rating scale (described in detail below). This allows participants to get used to gauging the strength of their efficacy beliefs and also can provide insight into misunderstandings regarding how to use the scale. The example given in the guidelines was utilized. Specifically, the participant was asked "If you were asked to lift objects of different weights right now, how certain are you that you can lift each of the weights described below?". The weights listed were 10, 20, 50, 100, 200, and 3600 pounds, and participants were instructed to rate their degree of confidence by recording a number from 0% to 100% in intervals of ten.

### *Virtual Leader Self-Efficacy*

VLSE was measured using the 126 preliminary items developed at the beginning of Phase I. All items were randomized across participants to mitigate order effects, and all demographic information was gathered at the end of the survey. Prior to beginning the VLSE scale, participants were provided with the following instructions:

“Listed on the next page are a variety of virtual leader behaviors. If you were asked to execute these virtual leader behaviors in your virtual team right now, how confident are you that you could successfully perform them?

Please rate your degree of confidence by recording a number from 0 to 100 using the scale provided. For example, if you are certain you cannot do it at all, choose 0% since you have no confidence in your ability. If you are certain you can do it, choose 100% since you have 100% confidence in your ability.”

Responses were recorded with a 11-point Likert-type scale (1= 0% “Completely certain I cannot do it at all”, to 11 = 100%, “Completely certain I can do it”). This response scale aligns with the standard procedure of measuring the strength of self-efficacy beliefs, and was specifically selected based on Bandura’s (2006) guide for constructing self-efficacy scales.

### ***Demographics***

Participants were asked to indicate their employment status, age, sex, race/ethnicity, industry, completed education, number of years they have been a supervisor, number of years of experience working with virtual teams, how many people are on their virtual team, and what percentage of time their virtual team spends working face-to-face.

Last, a debriefing statement concluded the survey and thanked the participant for their time.

## **Study 1 Results**

### **Exploratory Factor Analysis**

An exploratory factor analysis (EFA; principal axis factoring, Direct Oblimin rotation) was applied to the 126 VLSE items using SPSS 25.0. There was no missing data. Fourteen initial factors with eigenvalues greater than 1 (Hinkin, 1998) were extracted. A total 76% of

variance was accounted for by the set of 14 factors, and the first factor accounted for 59%. The scree plot suggested a unidimensional scale. The pattern matrix indicated 57 items did not load greater than .3 or had crossloadings greater than .3. Thus, these 57 items were removed and another EFA was applied to the remaining 69 items using the same settings as before. This second EFA resulted in the extraction of six factors with eigenvalues greater than 1. A total of 69% variance was accounted for, and the first factor contributed 58%. Again, the scree plot indicated a unidimensional scale. Twenty-two items either crossloaded or did not load above .3, thus another EFA was conducted after removing these items. This third EFA applied to remaining 47 items resulted in the extraction of three eigenvalues greater than 1 (Table 1). The scree plot suggested a unidimensional scale. The pattern matrix (Table 2) indicated the second factor only contained crossloaded items, thus it was determined to be ambiguous. Further, the third factor, which did have some crossloadings, contained seven items with loadings greater than .3, however, the factor did not contribute enough explained variance (2.7%) to warrant lengthening the survey. Thus, it was determined that the structure of the scale was unidimensional; only items in factor 1 (excluding crossloads) were retained for the final VLSE scale.

### **Reliability Analysis**

A reliability analysis was conducted on the remaining 29 items. Cronbach's alpha coefficient was far above satisfactory ( $\alpha = .98$ ). Because of this adequacy, it is unnecessary to keep all 29 items, and scale brevity was pursued in a systematic manner. After examining Cronbach's Alpha if Item Deleted statistics for each item, only one item indicated its removal would result in a minute increase in reliability (.978 to .979). Nonetheless, this item was removed and the reliability analysis was conducted again. Cronbach's Alpha if Item Deleted

statistics were unhelpful for determining any other items to remove, thus, item content was examined next. As is necessary in scale development, there was a substantial amount of redundancy among items. Duplicates in meaning were removed, further narrowing the item pool. Items from all of the seven initially proposed dimensions were present in the remaining pool, thus, one item from each category was selected based on clarity and representativeness. A reliability analysis was then conducted on the seven items, which showed highly acceptable levels ( $\alpha = .93$ ). This unidimensional 7-item scale represent the finalized VLSE scale and was further tested in Phase II.

### **Hypothesis 1 Results.**

The proposed 7-factor structure was not supported. Rather, a unidimensional scale better represented the structure of the VLSE scale. Regardless, the seven categories of key virtual leader behaviors served as a strong foundation for building the scale, as represented in the high reliability statistic. Further, a parallel form was able to be developed as well.

### **Parallel Form of the VLSE Scale**

Given the adequacy of the items that were removed in the name of parsimony, a parallel form was constructed. Seven items were chosen to again represent each of the seven categories. Note that the trust item in both the parallel and actual form are the same due to a lack of additional trust-focused items to choose from. A reliability analysis was conducted on these seven items, resulting in satisfactory alpha levels ( $\alpha = .92$ ). Further, the VLSE parallel form and the VLSE scale were highly correlated ( $r = .94$ ). Thus, the parallel form was also further assessed in Phase II.

## **VLSE Trust Scale**

While it does not make sense to retain a factor that is not contributing much variance to the overall scale (such as in this study), this does not mean the excluded factor isn't tapping into something of importance. After examining the items that made up the third factor (see Table 2), it was determined that there was a strong theme of trust and shared leadership – both of which are integrally related – represented throughout the dimension. For example, items such as “Mend relationships with virtual team members who do not trust me.” and “Mitigate unpredictability in the virtual team.”, as well as “Let go of control over my virtual team’s tasks.” were loading onto that third factor. Thus, it was determined that while it is best to exclude those items from the VLSE scale, it would be beneficial to incorporate them into a second scale. After removing all crossloads, a reliability analysis was conducted on the remaining seven items from the third factor. The results showed adequate reliability ( $\alpha = .89$ ). Thus, the unexpected VLSE-Trust scale was included in Phase II for further testing as well.

## **Chapter 3 - Phase II: Scale Validation**

To properly examine the validity of the VLSE scale, developing a nomological network of theoretical relationships with existing constructs is vital in showing that the scale is measuring what it should be measuring (Campbell & Fiske, 1959; Hinkin, 1995; Messick, 1995). The following sections outline the expected relationships between other variables and the VLSE scale. Then, the study is described and measures utilized during the second wave of data collection are introduced.

## Hypotheses

### Virtual Leadership Experience

Mastery experience with a task is the strongest of the four evidence-based ways to directly enhance a person's self-efficacy for that task (Bandura, 2012). Specifically, when perseverant effort is put into leading a virtual team, and failures are taken as learning opportunities, which has been shown to lead to enhanced efficacy. Performing the task and succeeding at that task builds the necessary toolkit to perform well (Locke & Latham, 1994), and that successful performance will then impact perceptions of self-efficacy (Bandura, 1982). Research has shown positive correlations between past leader experience and leadership self-efficacy (McCormick et al., 2002). Thus, it was predicted that virtual leaders with more experience will have higher levels of VLSE.

*Hypothesis 2: VLSE will have a positive relationship with previous virtual leadership experience.*

### Team Diversity

As described extensively above, greater amounts of diversity (both functional and cultural) are barriers to trust (Hacker et al., 2019). Further, diversity was proposed as an obstacle to effective team functioning by Bell & Kozlowski (2002), as these barriers largely have to do with conflicting expectations and norms regarding how to handle interactions, leadership, decision making, and other factors (Scott, 2013). This diversity will make effective virtual leadership more difficult, and thereby could negatively impact virtual leader self-efficacy.

*Hypothesis 3: VLSE will have a negative relationship with team diversity.*

## **General Self-Efficacy**

Past research has shown consistent positive correlations between specific types of self-efficacy (such as VLSE) and general self-efficacy (Chen, Gully, Whiteman, & Kilcullen, 2000). Thus, it was expected that VLSE will be positively correlated with general self-efficacy.

*Hypothesis 4a: VLSE will be positively correlated with general self-efficacy.*

Given the positive correlations between general self-efficacy and state-level self-efficacy, it is also important to establish the utility of the VLSE scale over and above general self-efficacy. Thus, it is expected that after controlling for general self-efficacy, VLSE will significantly predict virtual leader performance and team performance.

*Hypothesis 4b: VLSE will show incremental validity over GSE when predicting leader and team performance.*

## **Organization-Based Self-Esteem**

To show evidence of divergent validity, another self-evaluative construct, Organization-Based Self-Esteem (OBSE; Pierce et al., 1989) was included in the survey. OBSE is defined as “the self-perceived value that individuals have of themselves as organization members acting within an organizational context” (p. 625). Employees high in OBSE feel that they are important to the organization and that they can have a worthwhile and meaningful effect. Generally, employees that are high in self-esteem are also likely to be high in self-efficacy (Bandura, 1977). Positive relationships between general and state-specific efficacy and OBSE have been documented as ranging between .19 and .65 (Pierce & Gardner, 2004), but leader OBSE has not been studied, as the main focus has been on how leaders impact a follower’s OBSE. Thus, because of these past relationships, it is important to show that VLSE is distinct from OBSE.

*Hypothesis 5: VLSE will be distinct from Organization-Based Self-Esteem.*

**Sex.**

Women are more effective at shared leadership than men (Muethel et al., 2012), thus, they could have stronger VLSE given the need for shared leadership. However, there is evidence against this proposition. Women have reported significantly lower leadership self-efficacy than men (Morris, 1998; Murphy, 1992; McCormick, 2001; McCormick et al., 2002; Bakken et al., 2003; Hoyt, 2005). This is likely due to the societal norm of leadership being seen as a masculine role (Eagly & Karau, 1991), which comes with negative performance expectations due to the implicit assumption that women are worse leaders than men. Research examining sex role stereotypes typically show that men are perceived to be more competent than women on masculine-type tasks (Broverman et al., 1972; Deaux, 1976), which leads to the likely scenario that their self-efficacy will be lower, as they expect success with less certainty. This results in an opportunity for stereotype threat (Steele, 1997; Correll, 2004; Davies et al., 2005; Burgess et al., 2012; Isaac et al., 2012) to occur, where usually high-performing, competent women will underperform in comparison to their capabilities. Thus, it is predicted that women will have lower VLSE than men.

*Hypothesis 6: Sex differences in VLSE will be present, such that women will have lower VLSE than men.*

**Leader's Team Trust**

Given the vital role that trust plays in effective virtual leadership and effective virtual team functioning, a virtual leader's trust in their team is likely to impact their VLSE via the effect team trust has on virtual team performance. If a virtual leader does not trust their team, all evidence above points to that team performing relatively poorly. Thus, it is likely that the

leader's VLSE will be low. Similarly, if a virtual leader does trust their team, it is anticipated that the leader's VLSE would be higher given that the team will be more likely to perform well. This is understandable given the theorized upward spiral of leader self-efficacy that occurs when a team performs well, and the downward spiral of leader self-efficacy that occurs when a team performs poorly, since these performance experiences serve to recalibrate any errors in a leader's estimate of their own self-efficacy for leading (Bandura, 1997).

*Hypothesis 7: VLSE will be positively related to the leader's trust in their team.*

### **Leadership Performance (Self-rated) and Team Performance (Leader-rated)**

A substantial amount of research has linked higher levels of self-efficacy to better performance at work (Stajkovic & Luthans, 1998) and in a variety of other domains such as academic achievement, athletic performance, decision making, teaching, and others (Bandura, 1997). Leader performance has not been examined often, however (McCormick et al., 2002; Anderson et al., 2008; Hannah et al., 2008), but when it has, higher self-efficacy is related to greater effectiveness (Paglis & Green, 2002; Stajkovic & Luthans, 1998; Wood & Bandura, 1989). Thus, it was predicted that higher levels of VLSE will be related to greater leader performance and team performance. These relationships, however, will likely also be moderated by task complexity and virtuality.

*Hypothesis 8: VLSE will be positively related to leader performance and team performance.*

### **Task Complexity**

As described above, higher levels of the team's task complexity make leading virtual teams more difficult (Bell & Kozlowski, 2002), which could result in fewer people having the confidence to do so. When teams are characterized by additive, sequential work arrangements

where they don't have to actively collaborate, a virtual leader's task will be less complex than if they were leading a team with an intensive work arrangement where team members collaborate on a project in a synchronized manner. This will make the task harder, which will impact perceptions of difficulty and the self-efficacy of the leader (Bandura, 1986). Higher task complexity has also been shown to attenuate the relationship between self-efficacy and performance (Stajkovic & Luthans, 1998), and shared leadership and performance (Innocenzo, Mathieu, & Kukenberg, 2016). Thus, leader task complexity, operationalized as the type of work arrangement and interdependence that describes their team, will likely have a negative effect on VLSE – performance relationship.

*Hypothesis 9: Task complexity will moderate the relationship between VLSE and leader performance, such that at higher levels of task complexity, the relationship will be attenuated.*

*Hypothesis 10: Task complexity will moderate the relationship between VLSE and team performance, such that at higher levels of task complexity, the relationship will be attenuated.*

## **Virtuality**

As outlined above, higher levels of virtuality will likely result in leadership behaviors needing to change more drastically. This can result in VLSE being more important, as this heightens the difficulty of the task and will impact perceptions of difficulty and the self-efficacy of the leader. Shared leadership has been shown to matter equally for teams all across the virtual spectrum, even while high levels of virtuality attenuated the hierarchical leadership - team performance relationship and strengthened the relationship between structural supports and team performance (Hoch & Kozlowski, 2014). Given the focus on virtual leader efficacy for the specific behaviors that will lead to better effectiveness, the opposite moderating effect proposed for task complexity is expected for virtuality.

*Hypothesis 11: Virtuality will moderate the relationship between VLSE and leader performance, such that at higher levels of virtuality, the relationship will be strengthened.*

*Hypothesis 12: Virtuality will moderate the relationship between VLSE and team performance, such that at higher levels of virtuality, the relationship will be strengthened.*

## **Age**

Last, a research question was proposed. The question of whether workers from various generations view virtual teams differently has received hardly any empirical consideration. Millennials reported the lowest levels of confidence in their ability to lead virtual teams compared to Generation X and Baby Boomer leaders (DDI, The Conference Board, & EY, 2018). However, younger people align better with virtual teams (Muethel et al., 2012). Thus, this research question served to examine the relationship between VLSE and age.

*Research Question 1: Is age related to an individual's level of virtual leader self-efficacy?*

## **Study 2: Method**

### **Sample and Procedure**

An identical target sample and procedure as described in Study 1 was utilized. The survey contents included the finalized 7-item VLSE scale resulting from Study 1, the 7-item VLSE parallel form, the 7-item VLSE-Trust measure, and the validation measures as described below (Appendix C).

A total of 253 participants completed the online survey. The responses and calibration questions were examined for quality and found no incomplete responses or concerning response patterns. Next, the VLSE scale, parallel form, and VLSE Trust scale were tested for multivariate assumptions. After assessing for univariate outliers ( $z > |3.29|$ ), 2 participants in the VLSE scale

(#71 and #19), one participant from the parallel form (#71) and one participant from the VLSE Trust scale (#236) were identified as problematic cases. The three participants were removed. PP Plots showed the skewness and kurtosis of the scales was adequate, thus, no transformations were needed and standards for univariate normality were met. Mahalanobis distance was utilized to examine multivariate outliers ( $p = .001$ , 7 variables, critical value = 24.32). Twenty-three cases were identified. For the VLSE scale, nine participants had critical values above 24.32. For the parallel form, eight participants had critical values above 24.32, and for the VLSE Trust scale, six did. Four participants were problematic on multiple scales, thus 19 participants were removed from the analysis. See table 3 for full details. Multivariate normality was then tested and it was adequately met as well. Thus, 231 participants were included in the confirmatory factor analysis.

Univariate assumptions were then tested for the remaining validation scales. Fourteen cases of outliers ( $z > |3.29|$ ) were identified. Eight participants were removed to resolve these cases. See Table 4 for outliers in each scale. Multicollinearity and normality were also tested, and all assumptions were met. Thus, 245 participants were included in the validation analyses.

### **Sample Characteristics**

The sample consisted of almost twice as many males ( $n = 167$ , 66%) as females ( $n = 86$ , 34%). Participants mainly identified as Caucasian/White (77.1%) with some reporting African American/Black (7.1%), Asian/Pacific Islander (7.5%), and Hispanic/Latino/Latina (5.1%). Three participants were Native American, four endorsed “other”, and one preferred not to say. Additionally, participants also reported their highest level of completed education. The sample was highly educated, with 72% holding either a Bachelor’s (35.2%), Master’s (28.9%), Doctoral (4.0%), or Professional degree (4.3%). The remaining 28% consisted mainly of participants with an Associate degree (11.1%), some college but no degree (10.3%), or a high school degree

(6.3%). The vast majority of participant employment status was full-time (98.8%), with a few participants only working part-time ( $n = 3$ ). Participant ages ranged from 25 years old ( $n = 3$ ) to 82 years old ( $n = 1$ ), with most falling within 30 to 65 years of age (89%). The mean age was 40 years old. While a wide variety of industries were represented, a large portion came from technology (18.6%). An additional 42% of respondents worked in manufacturing (8.7%), information (6.3%), construction (5.9%), financial services (4.7%), retail (5.5%), health (4.3%), or other industries not listed (6.7%). Education (3.6%), communications (2.8%), banking (2.8%), computer (2.4%), environmental (2.0%), government (2.4%), and real estate industries (2.0%) made up another 17.8% as well. The remaining 21% consisted of small percentages of respondents ( $< 2\%$ ) from 23 different industries.

## **Measures**

### **Virtual Leadership Experience**

Virtual leadership experience was measured with one question. The respondents were asked to report (in two-year increments; 1-2 years, 3-4 years, etc.) how many years of virtual leadership experience they have.

### **Team Diversity**

Both functional and cultural diversity were measured via the leader's perceptions of diversity, as no access to actual team diversity could be attained. Specifically, perceived functional diversity, which assesses diversity in knowledge, skills, and abilities, was measured using Harrison and Klein's (2007) three-item scale ( $\alpha = .73$ ). Participants were instructed to think about their virtual team, then to please indicate how varied their team is with regard to each person's background, knowledge, and experience. Each item was rated on a 5-point Likert-type scale ("All members have the same knowledge/experience" to "Each member possesses unique

knowledge/experience”). A sample item is “To what extent do members of this virtual team possess distinct functional knowledge or expertise? (e.g., marketing, finance, accounting, management)”.

Perceived subjective diversity was chosen to operationalize a broader form of cultural diversity, since true cultural diversity of the team was not feasible to assess. An adapted measure ( $\alpha = .75$ ; Van Dick et al., 2008) based on a paper by Harrison and colleagues (1998) assessing surface-level and deep-level diversity components was utilized in this study. Participants were instructed to think of their virtual team, then to please rate how similar or different their team members are regarding the following characteristics. Age, gender, ethnic background, educational background, personal values, attitudes about work, and learning goals. Then, a single general item asking how diverse the leader thinks the virtual team is in general was presented as well. Responses were rated on a 7-point Likert-type scale (“completely similar” to “completely different”).

### **General Self-Efficacy**

General self-efficacy was measured using Schwarzer and Jerusalem’s (1995) 10-item General Self-Efficacy Scale ( $\alpha = .76-.90$ ). Responses were recorded on a 4-point Likert-type scale (“not true at all” to “exactly true”). Participants were instructed to think of themselves right now and use the scale to indicate their level of agreement or disagreement with each statement. An example item is “When I am confronted with a problem, I can usually find several solutions”.

### **Organization-Based Self-Esteem**

Organization-based self-esteem was measured using Pierce and colleague’s (1989) 10-item scale ( $\alpha = .86$ ). Participants were instructed to think about the messages they receive from

the attitudes and behaviors of their own managers and supervisors, then rate their agreement with the statements provided. An example item is “I can make a difference around here”. Responses were recorded on a 7-point Likert-type scale (“strongly disagree” to “strongly agree”).

### **Leader’s Team Trust**

A leader’s trust in their team was measured with Spreitzer and Mishra’s (1999) 16-item scale assessing how much a leader trusts their team. The scale was found in Dietz and Den Hartog’s (2006) paper regarding how trust should be measured in organizations. Agreement was rated on a 7-point Likert-type scale (“strongly disagree” to “strongly agree”). An example item is “I trust that my virtual team members are competent in performing their jobs”.

### **Leadership Performance (Self-rated)**

Self-rated leader performance was measured using a 23-item custom-built appraisal to allow for the utilization of a behavior-based view of leader performance. The Leadership Skills Strataplex (Mumford, Campion, & Morgeson, 2007), which lays out four basic leadership skillsets required for all leaders, served as the theoretical framework for the scale. These areas included cognitive skills, interpersonal skills, business skills, and strategic skills. Each area consists of key subcategories as well. Then, Bell & Kozlowski’s (2002) team-focused virtual leadership theory was utilized to write relevant items for each category and subcategory of the leadership skills strataplex. Items were reviewed by a subject matter expert, then the list was pared down. See Appendix D for details. Leaders were instructed to please rate how well the statements described their behavior as a leader. All items were rated on a 5-point Likert-type scale (“does not describe me” to “describes me extremely well”). An example item is “Clearly expresses ideas, thoughts, and directions in written communication to virtual team members”.

### **Team Performance (Leader-rated)**

Leader-rated team performance was measured using a scale that has been previously utilized in assessing virtual team performance. Specifically, Van de Ven and Ferry's (1980) 8-item measure ( $\alpha = .92$ ) was selected. Participants were instructed to rate on a 5-point Likert type scale ("poor" to "excellent") their virtual team. Eight areas of focus were provided, including the quantity or amount of work produced, the number of innovations or new ideas introduced by the team, reputation for work excellence, attainment of team production or service goals, the quality or accuracy of work, efficiency of team operations, morale of team personnel, and adherence to schedule and budget.

### **Task Complexity**

Leadership task complexity was measured by assessing the task interdependence of their virtual team. Specifically, Staples and Webster (2010) adapted two scales (Bishop & Scott, 2000; Janssen et al., 1999) to assess team task interdependence in their virtual teams research. Their 6-item measure ( $\alpha = .76$ ) was utilized in this study. Specifically, leaders were instructed to please think of how their virtual team members work together, and then rate how well each of the items describe their virtual team. An example item is "Virtual team members must coordinate their efforts with each other". Agreement was rated on a 7-point Likert-type scale ("strongly disagree" to "strongly agree").

Additionally, a measure was constructed to tap into the 4 types of work arrangements Bell & Kozlowski (2002) discuss. Items were written to describe additive, sequential, reciprocal, and intensive work arrangements. For example, the item representing the additive arrangement was "Work activities are separately conducted, then all team members combine their contribution into the final product". Leaders rated how much each statement described their

virtual team with a 7-point Likert-type scale (“does not describe my team” to “completely describes my team”).

### **Virtuality**

Flex time and shift work options mean that employees can work at the same physical location as their team, but not actually be able to work face-to-face. On the contrary, some teams may be physically dispersed but have the resources to meet face-to-face often. Thus, to be considered a virtual team, either geographic dispersion or asynchronous work hours must be present, which results in a dependence on technology to aid in communication. This dependence on technology will serve as a means to determine the degree of virtuality for each leader’s team. A common way to measure this dependence is to either assess the proportion of team work that is completed virtually, or alternatively, to assess the proportion of team work time that is occurring face-to-face (Kirkman & Mathieu, 2005; Schweitzer & Duxbury, 2010; Fiol & O’Connor, 2005). Thus, virtuality was measured with one item by asking the team leader what percentage of time the team works face-to-face. These values were subtracted from 100% to represent the percent of time the team works virtually. For example, if a leader reports the team spends 25% of time face-to-face, the team is considered 75% virtual.

### ***Degree of Separation***

Sometimes employees work for the same company but are based at different locations around the city, state, country, or even the globe. Understanding the degree of separation of the team can provide more insight into the separation of team members. Depending on how financially stable the company is, getting those teams together could be extremely easy or extremely hard. Thus, additional data was gathered to allow for further differentiation among virtual teams if needed. Specifically, leaders were asked to rate their level of agreement on a 7-

point Likert-type scale (“strongly disagree” to “strongly agree”) to five statements describing how often they see their team members face-to-face over a variety of time spans (daily, monthly, yearly). An example item is “I see all my team members in person daily”.

### **Demographics**

Participants were asked to indicate their employment status, age, sex, race/ethnicity, industry, completed education, number of years they have been a supervisor, number of years of experience working with virtual teams, and how many people are on their virtual team.

Additionally, minor verbiage was changed in various scales to specifically reference virtual teams when necessary. Last, a debriefing statement concluded the survey and thanked the participant for their time.

## **Results**

### **Scale Reliability and Measurement Model**

A Cronbach’s alpha reliability analysis was conducted using SPSS 25.0 to assess the three VLSE scales (VLSE, VLSE Parallel Form, VLSE Trust). Then, a confirmatory factor analysis (CFA) using Jamovi was applied to each scale to test the adequacy of the measurement model. See Table 5 for a summary of results.

#### **VLSE Scale**

The VLSE scale reliability was highly acceptable ( $\alpha = .89$ ). No item removals increased the scale reliability, thus the 7-item unidimensional scale was tested in the CFA.

The results of the CFA showed the chi-square test was nonsignificant ( $\chi^2 = 12.1$ ,  $df = 14$ ,  $p = .600$ ,  $CFI = 1.00$ ,  $TLI = 1.00$ ,  $RMSEA = 0.00$ ). This confirms the appropriateness of the unidimensional scale structure.

#### **VLSE Parallel Form**

The VLSE Parallel Form scale reliability was also highly acceptable ( $\alpha = .87$ ). One item removal would increase the scale reliability by .01, however, it was determined that this minor increase did not warrant removing the item. The correlation between the parallel form and the VLSE scale was .84 in this sample. Thus the 7-item unidimensional scale was tested in the CFA.

The results of the CFA chi-square test again showed sufficient model fit via no significance ( $\chi^2 = 17.5$ ,  $df = 14$ ,  $p = .231$ ,  $CFI = .995$ ,  $TLI = .992$ ,  $RMSEA = .033$ ). Based on these results, the unidimensional scale structure was deemed appropriate.

### **VLSE Trust Scale**

The VLSE Trust scale reliability was also acceptable ( $\alpha = .77$ ). Removing one item showed an increase in the scale reliability to .83. This item also had very small inter-item correlations and a negative inter-item correlation ( $r = -.01$  to  $.17$ ). Thus, item 7 was removed. The final scale reliability was .83. The 6-item unidimensional scale was tested in the CFA.

The results of the CFA, namely the nonsignificant chi-square statistic, again indicated good model fit ( $\chi^2 = 14.6$ ,  $df = 9$ ,  $p = .102$ ,  $CFI = .988$ ,  $TLI = .980$ ,  $RMSEA = .052$ ). This confirms the suitability of the unidimensional scale structure.

### **Validating the Scales**

In sum, all three scales showed adequate reliability and the unidimensional factor structure was deemed appropriate. See Appendix E for the finalized scales. Next, the three scales were further validated. The same hypotheses were examined for the parallel form and the VLSE Trust scale as well. Means, standard deviations, and intercorrelations among variables are presented in Table 6.

### **Testing Hypothesis 2**

Hypothesis 2 stated VLSE will have a positive relationship with previous virtual leadership experience. As seen in Table 6, only the correlation between VLSE and virtual leader experience (in years) was significant ( $r = .16$ ). However, this correlation is very small. The correlations between virtual leader experience and other two VLSE scales (the VLSE parallel form and the VLSE Trust measure) were nonsignificant. Thus, hypothesis 2 was only partially supported.

### **Testing Hypothesis 3**

Hypothesis 3 stated VLSE will have a negative relationship with team diversity. To test this, correlations between functional diversity, general diversity, and the three scales were examined (Table 6). Correlations between general diversity and the three scales were nonsignificant. Further, functional diversity, while the correlations were negative, was not significantly correlated with any of the three scales either. Thus, hypothesis 3 was not supported.

### **Testing Hypothesis 4**

Hypothesis 4a stated VLSE will be positively correlated with general self-efficacy. Correlations between general self-efficacy and the VLSE scale ( $r = .45$ ), VLSE Parallel form ( $r = .54$ ) and the VLSE Trust scale ( $r = .35$ ) were indeed positive and significant ( $p < .000$ ; Table 6). Thus, hypothesis 4a was supported.

Hypothesis 4b stated that VLSE will show incremental validity over GSE when predicting leader and team performance. To test this, linear regression analyses were conducted to compare two models; the first contained GSE as a predictor, and the second contained VLSE, the parallel form, or VLSE Trust as a predictor. The significance of the change in r-squared was assessed. This was repeated for each of the three VLSE scales and to predict leader performance and team performance. All six regression analyses showed significant results ( $p < .001$ ) for the

model comparisons. Specifically, when predicting leader performance, the VLSE scale ( $F(1, 242) = 29.10, \Delta R^2 = .07, p < .001$ ), the VLSE Parallel Form ( $F(1, 242) = 12.80, \Delta R^2 = .03, p < .001$ ), and the VLSE Trust scale ( $F(1, 242) = 17.3, \Delta R^2 = .04, p < .001$ ) all contributed over and above GSE. Similarly, when team performance was predicted, the results again showed that the VLSE scale ( $F(1, 242) = 23.90, \Delta R^2 = .07, p < .001$ ), the VLSE Parallel Form ( $F(1, 242) = 18.20, \Delta R^2 = .05, p < .001$ ), and the VLSE Trust scale ( $F(1, 242) = 11.8, \Delta R^2 = .03, p < .001$ ) all contributed to the model over and above GSE. Thus, hypothesis 4b was supported as well.

### **Testing Hypothesis 5**

Hypothesis 5 stated VLSE will be related to but distinct from Organization-Based Self-Esteem (OBSE). These relationships were examined by comparing OBSE's and the VLSE scales' correlations with the square root of the product of the two scale's reliabilities, which represents the maximum potential correlation between the measures. The maximum possible correlation was much greater than the actual correlations between OBSE and the VLSE scale ( $r = .88$ ;  $r = .46$ ), the VLSE Parallel Form ( $r = .88$ ;  $r = .49$ ), and the VLSE Trust scale ( $r = .86$ ;  $r = .39$ ). This indicates that while related, the VLSE scales and the OBSE scale are accounting for far less than the maximum possible shared variance between the two scales (See Tables 6 and 7) and therefore are distinct. Thus, hypothesis 5 was supported.

To show additional evidence of convergent validity with both GSE and OBSE, the Average Variance Extracted (AVE) was computed for GSE, OBSE, and each of the three VLSE scales. Only the VLSE scale's AVE value met the .50 threshold (Fornell & Larcker, 1981). The VLSE Parallel Form and the VLSE Trust scale AVE values were just barely below this cutoff (.48 and .48). Discriminant validity was also further assessed by square rooting the AVE value and comparing it to the factor correlations (Taylor et al., 2019). These values (VLSE = .71,

VLSE PF = .69, VLSE T = .69) were larger than the factor correlations between GSE and the VLSE scale ( $r = .18$ ), the parallel form ( $r = .20$ ), and the VLSE Trust scale ( $r = .18$ ), as well as between OBSE and the VLSE scale ( $r = .39$ ), the parallel form ( $r = .39$ ), and the VLSE Trust scale ( $r = .41$ ) again indicating adequacy.

### **Testing Hypothesis 6**

Hypothesis 6 stated sex differences in VLSE will be present, such that women will have lower VLSE than men. The results of a regression analysis revealed sex did not significantly predict VLSE ( $F(1, 244) = 1.509$ ,  $R^2 = 0.005$ ,  $p = .284$ ), indicating that sex and VLSE are not related and therefore no sex differences exist in this sample. There was also no relationship between sex and the VLSE parallel form ( $F(1, 244) = .34$ ,  $R^2 = .001$ ,  $p = .560$ ) nor the VLSE-Trust form ( $F(1, 244) = .039$ ,  $R^2 = -.004$ ,  $p = .843$ ). Thus, hypothesis 6 was not supported.

### **Testing Hypothesis 7**

Hypothesis 7 stated VLSE will be positively related to the leader's trust in their team. Correlations between leader trust and the VLSE scale ( $r = .45$ ), the VLSE Parallel form ( $r = .46$ ) and the VLSE Trust scale ( $r = .40$ ) were positive and significant ( $p < .000$ ; Table 6). Thus, hypothesis 7 was supported.

### **Testing Hypothesis 8**

Hypothesis 8 stated VLSE will be positively related to leader performance and team performance. To test this, correlations between the two performance measures and the three VLSE scales were examined. All six correlations were positive and significant ( $r = .35$  to  $.50$ ,  $p < .001$ ). As such, hypothesis 8 was supported. See Table 6 for specific correlations.

### **Testing Hypothesis 9**

Hypothesis 9 stated task complexity will moderate the relationship between VLSE and leader performance, such that at higher levels of task complexity, the relationship will be attenuated. To test this, three regressions (one for each VLSE scale) predicting leader performance were conducted. Three predictors, VLSE, task complexity, and their interaction term were entered to be examined. This procedure was repeated for the VLSE parallel form and the VLSE-Trust scale. In all three regressions, the main effects of VLSE and task complexity were significant, however, the interaction term was not (Table 8). Thus, hypothesis 9 was not supported as task complexity did not moderate the relationship between the VLSE scales and leader performance.

#### **Testing Hypothesis 10**

Hypothesis 10 stated task complexity will moderate the relationship between VLSE and team performance, such that at higher levels of task complexity, the relationship will be attenuated. To test this, the same procedure described for hypothesis 9 was utilized except the criterion variable was team performance. The results of the three regression analyses were uniform across the three scales. Specifically, the main effects of VLSE and task complexity were significant, and the interaction term was not significant (Table 9). This indicates that task complexity does not moderate the effect of VLSE on team performance. Thus, hypothesis 10 was not supported.

#### **Testing Hypothesis 11**

Hypothesis 11 stated virtuality will moderate the relationship between VLSE and leader performance, such that at higher levels of virtuality, the relationship will be strengthened. To test this, three regressions (one for each VLSE scale) predicting leader performance were again conducted. Three predictors, VLSE, task complexity, and their interaction term were entered to

be examined. All variables were centered. This procedure was repeated for the VLSE parallel form and the VLSE-Trust scale. In all three regressions, the main effect of VLSE was significant, the main effect of virtuality was not, and the interaction between the two variables was nonsignificant (Table 10). This nonsignificant interaction indicates virtuality does not moderate the effect of VLSE on team performance. Thus, hypothesis 11 was not supported.

### **Testing Hypothesis 12**

Hypothesis 12 stated virtuality will moderate the relationship between VLSE and team performance, such that at higher levels of virtuality, the relationship will be strengthened. To test this, the exact procedure described to test hypothesis 11 was utilized with team performance as the criterion variable. Again, in all three regressions, the main effect of VLSE was significant, the main effect of virtuality was not, and the interaction between the two variables was nonsignificant (Table 11). Thus, hypothesis 12 was not supported as the interaction term was not significant.

### **Testing Research Question 1**

To test if age was related to VLSE, correlations were examined (Table 6). There were no significant correlations between age and the three VLSE measure. Thus, in this sample, there is no relationship between VLSE and age.

## **Chapter 4 - Discussion**

The main objective of this research was to create a reliable and valid means of measuring virtual leader self-efficacy. Through two phases, three unidimensional, psychometrically sound VLSE scales were developed, and preliminary content, discriminant, nomological, and incremental validity were established. These outcomes suggest this goal was largely achieved. Specifically, content and face validity were established from a rigorous literature review and

multiple examinations of the items by SMEs. Convergent validity was assessed with an AVE analysis (Fornell & Larcker, 1981) as well as hypotheses establishing positive relationships with general self-efficacy and leader trust. Incremental validity was established beyond GSE and discriminant validity was demonstrated through distinctiveness with VLSE, OBSE, and GSE. Concurrent validity was also established with leader and team performance. These findings provide valuable and these highly reliable and valid measures will provide a strong foundation for future research in this area.

This research provided the scientific community with a valuable opportunity to learn more about efficacy for leading teams in a virtual environment. It has advanced the combined knowledge base of leadership, self-efficacy, and virtual teams. No prior research has examined these three realms together. Successful establishment of the nomological network of the three VLSE scales served to expand the boundaries of our knowledge. Overall, this study has shown that VLSE is indeed positively related to both leader and team performance, which is indicative of its potential practical utility in organizations. Further, it was found that a leader's trust in their team is important for both their own confidence in their ability to lead their team as well as for the team's performance. These scales demonstrated distinctiveness from other self-evaluative constructs such as Organization-Based Self-Esteem and GSE, and showed incremental validity over GSE as well, which can help to enhance predictive power in organizations and in future research.

Surprisingly, greater virtual leader experience was not related to higher levels of VLSE for the parallel form or the trust scale, and only a very small positive significant correlation was found between the VLSE form and virtual leader experience. A variety of factors could be at play here. This might indicate that the operationalization of past experience in terms of years

inadequately represents a leader's past performance experience, which is likely given the robust literature supporting this hypothesis. Past experience might not equate well to past performance, as past mastery experiences only enhance efficacy expectations if they are tied to positive outcomes and are appropriately attributed to the individual's skill and effort rather than luck or chance (Bandura, 1977). Future research should examine other operationalizations of past performance to examine this effect. Additionally, it is possible that the pandemic is creating a history confound effect, as it has forced people into a situation where they are working with virtual teams daily. For example, Bandura (1992) stated that when facing complex and unfamiliar environments, individuals rely heavily on past performance to judge their efficacy. As the environment becomes more familiar, past performance is less relevant for this judgement. Thus, as employees become more familiar with leading in a virtual environment, the importance of past performance for determining efficacy could diminish. The pandemic has served as a crash course in leading virtually for many and it is possible the experience gained in 2020 is more important than past years of experience and performance. However, it is possible that this null finding means that other factors are more important to influencing VLSE than past experiences. Given self-efficacy's emphasis on mastery tasks to expand state-level efficacy, this finding warrants deeper investigation.

Task complexity was positively related to VLSE but did not moderate the relationship between the VLSE scales and performance. While this moderation hypothesis was based on Bell and Kozlowski's taxonomy of virtual teams, it had not been previously tested. Past studies not focused on virtual leaders have obtained this same null moderation finding as well (Ali et al., 2018). More research should examine this effect with other operationalizations of task complexity to further identify any boundary conditions at play here. Additionally, virtuality was

not related to the VLSE scales and did not moderate the relationship between VLSE and performance. This relationship is an assumption in virtual teams research that is frequently touted but rarely examined. It is possible this lack of an effect is accurate, but it also could be due to a lack of a validated virtuality measure while massive amounts of operational discord exist in the field. For example, this study took a more numerical approach to capturing virtuality, but it might be more appropriate to examine virtuality in a manner that is focused on perceptions of hindrances that come from distance, separation, asynchronous work and other potential dimensions discussed above. If a leader does not perceive these factors to make their job more difficult, that is what matters, not what the objective reality is in that situation. Thus, further research on what constitutes virtuality and how best to measure it is necessary for virtual teams research to thrive.

These studies also provided an opportunity to learn about what is not relevant for VLSE. At least in this sample, age does not appear to matter, nor is sex or team diversity related to VLSE. As mentioned above, past experience is also less important. In all, these results could suggest that this new leadership environment is a great equalizer, with effects that are typically salient in face-to-face teams being attenuated. This could be hopeful for young, old, male, and female leaders alike leading teams from a variety of backgrounds as it levels the playing field for all. Only future research in this area will advise these speculations. Self-efficacy theory has an enormous body of literature and testing its generalizability in virtual environments is necessary.

In addition to the theoretical contributions to self-efficacy theory, leadership research, and teams research mentioned above that serve to expand our knowledge base, this research offers practical implications. Three useful tools were developed – the VLSE scale, the parallel form, and the VLSE Trust scale. One potential area of application is that of leader training and

development. A useful function of the VLSE scales could be to employ them in a training needs analysis (Salas et al., 2012). This analysis is a necessary first step for any training development effort to be successful, as it diagnoses what specific skills need to be the focus of the training, who the training should target, and how the training can support the overall organizational system. Enabling a productive trainee mindset is crucial to maximizing training effectiveness (Salas et al., 2012), and adapting the VLSE scales to reference their confidence in their ability to learn these skills during training can allow for a better understanding of the areas a virtual leader feels most insecure. This can allow the trainer to build their self-efficacy, thus enhancing their probability of transferring the training to their jobs as it enhances the quality of their learning (Salas et al., 2012). The VSLE scales could be useful to identify leaders in need of training, as well as the key areas training are needed depending on the pattern of responses among trainees. Further, the knowledge gained from the study's literature review can aid in developing employee and leader trainings to enhance virtual communication, trust building, and shared leadership, as well as the other areas of focus mentioned above. Additionally, these scales can be adapted for followers to assess their leaders, thus allowing them to rate their confidence in their leaders ability to perform the behaviors. This would further enhance the quality of work life for both leaders and followers alike. Last, employing Bandura's methods of enhancing self-efficacy (Bandura, 2009, 2012) could enhance virtual leader performance itself. Ensuring to assess baseline performance levels prior to training is necessary, however, as it is crucial to uphold as much experimental control as possible (Salas et al., 2012) to determine if enhancing efficacy indeed is driving performance in that organization. The VLSE parallel form can be very useful in longitudinal studies such as these.

## **Limitations and Future Directions**

Although the findings here stem from solid research, the studies were not without limitations. Self report was utilized, which can lead to issues such as common method bias (Podsakoff, MacKenzie, & Podsakoff, 2003). This potential for inflation of relationships due to the data collection method is seen as serious by some, but less of a concern by others (Spector, 2006). A follower-focused measure could reduce some of the concerns regarding common method bias. Self-report can also lead to social desirability issues (Crowne & Marlowe, 1960), and other kinds of response biases (Donaldson & Grant-Vallone, 2002; Stone et al., 2002), which can be particularly concerning for the leader performance measure. Self-report ratings of performance can correlate quite low with other sources of performance ratings, such as supervisor and peer ratings and these ratings can be inflated (Conway & Huffcutt, 1997). However, some evidence has shown self-ratings of leadership performance can have agreement with other rating sources (Lee & Carpenter, 2018). Thus, a more objective measure of leadership performance should be utilized in future research (see Hiller et al, 2011 for a review). Further, the Qualtrics sample generally consists of employees who are willing to spend their free time taking surveys, and this in itself could hinder generalizability. The sample was highly educated, which is more expected of employees holding leadership positions, and the majority of the sample was white, thus, additional research is needed to expand upon the generalizability of the scales into different cultures and demographic representations. An additional limitation regards the cross-sectional design of the studies. This limits the conclusions that can be drawn from the data. No causation can be assumed, but future studies should aim for assessing the effects of time on VLSE. Again, the parallel form will prove useful for these types of studies. As for the

validation of the scales, criterion-related validity via predictive validity could not be examined in this study, but evidence for this is greatly needed from future research.

Additional research also is needed to further expand the nomological network of the VLSE scales. Teasing apart the differences between the VLSE scale the VLSE trust scale should be a key focus as well. These two constructs are understandably closely related, but there are meaningful differences given the EFA demonstrated participants are not responding in the same manner to these two scales. Further, the temporal stability of VLSE needs to be assessed in future research. State-level self-efficacy is malleable and can be impacted by both internal determinants (effort, ability) as well as external determinants (the tasks, the environment; Gist & Mitchell, 1992). The VLSE parallel form can be utilized in longitudinal studies to help provide more experimental control when measuring this construct at multiple time points. Personality variables and other individual difference factors also must be assessed in relation to VLSE, as they could shed light on whether certain types of people have higher baseline levels of VLSE. It is also pertinent to examine VLSE's relationship with extremely important variables focused on employee wellbeing such as burnout, work-life balance, job satisfaction, work engagement, stress, and depression, particularly during such stressful times. Of course, more validation is needed to strengthen these scales and enhance their generalizability. Last, an item analysis utilizing Item Response Theory could improve the strength of the scale as well.

## **Conclusion**

As virtual teams become more and more prevalent, better understanding how virtual leaders can successfully guide their teams is of utmost importance. To do this well, reliable and valid tools are necessary for a strong foundation to be laid for future research, and this study served to set the cornerstone. The knowledge gained in this research helps to shed light on these

extremely relevant topics. Although this leadership environment is challenging, as communication technology advances, it will hopefully only become easier to work together virtually. With the accelerated use of virtual teams among many companies seeking to find a new normal amid the Covid-19 crisis (Caligiuri et al., 2020), understanding virtual leadership and a leader's confidence in their ability to lead in these changing environments will only continue to be of utmost importance. Thus, this research contributes to an imperative cause; examining virtual leadership must remain a key focus in the years ahead.

## References

- Al-Ani, B., Horspool, A., & Bligh, M. C. (2011). Collaborating with ‘virtual strangers’: Towards developing a framework for leadership in distributed teams. *Leadership*, 7(3), 219–249.
- Al-Ani, B., Marczak, S., Prikladnicki, R., & Redmiles, D. (2013). Revisiting the Factors that Engender Trust of Global Systems Engineers. In *2013 IEEE 8th International Conference on Global Software Engineering* (pp. 31–40). IEEE.
- Al-Ani, B., & Redmiles, D. (2009). In Strangers We Trust? Findings of an Empirical Study of Distributed Teams. In *2009 Fourth IEEE International Conference on Global Software Engineering* (pp. 121–130). IEEE.
- Ali, H. E., Schalk, R., Van Engen, M., & Van Assen, M. (2018). Leadership self-efficacy and effectiveness: The moderating influence of task complexity. *Journal of Leadership Studies*.
- Alsharo, M., Gregg, D., & Ramirez, R. (2016). Virtual team effectiveness: The role of knowledge sharing and trust.
- Ancona, D., & Chong, C. (1996). Entrainment: Pace, cycle, and rhythm in organizational behavior. In B. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 19, pp. 251-284). Greenwich, CT: JAI.
- Anderson, D. W., Krajewski, H. T., Goffin, R. D., & Jackson, D. N. (2008). A leadership self-efficacy taxonomy and its relation to effective leadership. *The Leadership Quarterly*, 19(5), 595-608.
- Aubert, B. A., & Kelsey, B. L. (2003). Further Understanding of Trust and Performance in Virtual Teams. *Small Group Research*, 34(5), 575–618.
- Axtell, C. M., Fleck, S. J., & Turner, N. (2004). Virtual teams: Collaborating across distance. In C. L. Cooper, & I. T. Robertson (Eds.), *International Review of Industrial and Organizational Psychology*, vol. 19. Chichester: Wiley.

- Bakken, L. L., Sheridan, J., & Carnes, M. (2003). Gender differences among physician–scientists in self-assessed abilities to perform clinical research. *Academic Medicine*, 78(12), 1281-1286.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84, 191–215.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist*, 37(2), 122.
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of social and clinical psychology*, 4(3), 359-373.
- Bandura, A. (1992). Social cognitive theory of social referencing. In *Social referencing and the social construction of reality in infancy* (pp. 175-208). Springer, Boston, MA.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.
- Bandura, A. (2006). Guide for constructing self-efficacy scales. *Self-efficacy beliefs of adolescents*, 5(1), 307-337.
- Bandura, A. (2009). Cultivate Self-Efficacy for Personal, E. A. Locke (Ed.): *Handbook of Principles of Organizational Behavior*, 2.
- Bandura, A. 2012. On the functional properties of self-efficacy revisited. *Journal of Management*, 38: 9-44.
- Bell, B. S., & Kozlowski, S. W. (2002). A typology of virtual teams. *Group and Organization Management*, 27, 14-49.
- Bettenhausen, K. (1991). Five years of group research: What we have learned and what needs to be addressed. *Journal of Management*, 17, 345-381.
- Bierly, P. E., Stark, E. M., & Kessler, E. H. (2009). The Moderating Effects of Virtuality on the Antecedents and Outcome of NPD Team Trust. *Journal of Product Innovation Management*, 26(5), 551–565.

- Bowers, C. A., Pharmer, J. A., & Salas, E. (2000). When member homogeneity is needed in work teams: A meta-analysis. *Small group research*, 31(3), 305-327.
- Brahm, T., & Kunze, F. (2012). The role of trust climate in virtual teams. *Journal of Managerial Psychology*.
- Breuer, C., Hüffmeier, J., & Hertel, G. (2016). Does trust matter more in virtual teams? A meta-analysis of trust and team effectiveness considering virtuality and documentation as moderators. *Journal of Applied Psychology*, 101(8), 1151–1177.
- Breuer, C., Hüffmeier, J., Hibben, F., & Hertel, G. (2019). Trust in teams: A taxonomy of perceived trustworthiness factors and risk-taking behaviors in face-to-face and virtual teams. *Human Relations*, 001872671881872.
- Broverman, I. K., Vogel, S. R., Broverman, D. M., Clarkson, F. E., & Rosenkrantz, P. S. (1972). Sex-Role Stereotypes: A Current Appraisal 1. *Journal of Social issues*, 28(2), 59-78.
- Brown, S., Gray, D., McHardy, J. and Taylor, K. (2015), “Employee trust and workplace performance”, *Journal of Economic Behavior & Organization*, Vol. 116, pp. 361-378.
- Burgess, D. J., Joseph, A., Van Ryn, M., & Carnes, M. (2012). Does stereotype threat affect women in academic medicine?. *Academic Medicine*, 87(4), 506.
- Caligiuri, P., De Cieri, H., Minbaeva, D., Verbeke, A., & Zimmermann, A. (2020). International HRM insights for navigating the COVID-19 pandemic: Implications for future research and practice. *Journal of International Business Studies*, 1.
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological bulletin*, 56(2), 81.
- Carson JB, TeslukPE, Marrone JA. 2007. Shared leadership in teams: an investigation of antecedent conditions and performance. *Academy of Management*. J. 50:1217–34.
- Carte, T. A., Chidambaram, L., & Becker, A. (2006). Emergent leadership in self-managed virtual teams. *Group Decision and Negotiation*, 15(4), 323-343.

- Chang, H. H., Chuang, S. S., & Chao, S. H. (2011). Determinants of cultural adaptation, communication quality, and trust in virtual teams' performance. *Total Quality Management, 22*(3), 305-329.
- Chen, G., Casper, W. J., & Cortina, J. M. (2001). The roles of self-efficacy and task complexity in the relationships among cognitive ability, conscientiousness, and work-related performance: A meta-analytic examination. *Human performance, 14*(3), 209-230.
- Chen, G., Gully, S. M., Whiteman, J. A., & Kilcullen, R. N. (2000). Examination of relationships among trait-like individual differences, state-like individual differences, and learning performance. *Journal of applied psychology, 85*(6), 835.
- Chudoba, K. M., Wynn, E., Lu, M., & Watson-Manheim, M. B. (2005). How virtual are we? Measuring virtuality and understanding its impact in a global organization. *Information systems journal, 15*(4), 279-306.
- Cohen, S. G., & Gibson, C. B. (2003, April). *Putting the team back in virtual teams*. Paper presented at the 18th annual conference of the Society for Industrial/Organizational Psychology, Orlando, FL.
- Colquitt, J.A., Scott, B.A. and LePine, J.A. (2007), "Trust, trustworthiness, and trust propensity: a meta-analytic test of their unique relationship with risk taking and job performance", *Journal of Applied Psychology, Vol. 92 No. 4*, pp. 909-927.
- Conway, J. M., & Huffcutt, A. I. (1997). Psychometric properties of multisource performance ratings: A meta-analysis of subordinate, supervisor, peer, and self-ratings. *Human Performance, 10*(4), 331-360.
- Contractor N, DeChurch L, Carson J, Carter D, Keegan B. 2012. The topology of collective leadership. *Leadership Quarterly. 23*:994–1011
- Correll, S. J. (2004). Constraints into preferences: Gender, status, and emerging career aspirations. *American sociological review, 69*(1), 93-113.

- Costa, A. (2003), "Work team trust and effectiveness", *Personnel Review*, Vol. 32 No. 5, pp. 605-622.
- Cousins, K. C., Robey, D., & Zigurs, I. (2007). Managing strategic contradictions in hybrid teams. *European Journal of Information Systems*, 16(4), 460-478.
- Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of consulting psychology*, 24(4), 349.
- Curşeu, P. L., Schalk, R., & Wessel, I. (2008). How do virtual teams process information? A literature review and implications for management. *Journal of Managerial Psychology*, 23(6), 628–652.
- Dabbish, L., R. Kraut. 2008. Awareness displays and social motivation for coordinating communication. *Information Systems Research*. 19(2) 221–238.
- Daft, R.L. and Lengel, R.H. (1986), "Organizational information requirements, media richness and structural design", *Management Science*, Vol. 32 No. 5, pp. 554-569.
- Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: identity safety moderates the effects of stereotype threat on women's leadership aspirations. *Journal of personality and social psychology*, 88(2), 276.
- Davis, D. D., & Bryant, J. L. (2003). Influence at a distance: Leadership in global virtual teams. *Advances in Global leadership*, 3,303–340.
- Davison, R., Bélanger, F., Ahuja, M., Watson-Manheim, M. B., DeLuca, D., & Valacich, J. S. (2006). Virtual teams in and out of synchronicity. *Information Technology & People*.
- Deaux, K. (1976). Sex: A perspective on the attribution process. *New directions in attribution research*, 1, 335-352.
- DDI, The Conference Board, & EY. (2018). *Global Leadership Forecast 2018: 25 research insights to fuel your people strategy*. Pittsburgh, PA: DDI.

- Dennis, A. R., Robert Jr., L. P., Curtis, A. M., Kowalczyk, S. T., & Hasty, B. K. (2012). Research note — Trust is in the eye of the beholder: A vignette study of postevent behavioral controls' effects on individual trust in virtual teams. *Information Systems Research*, 23(2), 546–558.
- DeRosa, D. M., Hantula, D. A., Kock, N., & D'Arcy, J. (2004). Trust and leadership in virtual teamwork: A media naturalness perspective. *Human Resource Management*, 43(2–3), 219– 232.
- DeSanctis, G., & Monge, P. (1998). Communication processes for virtual organizations. *Journal of Computer-Mediated Communication*, 3(4), JCMC347.
- DeVellis, R. F. (2017). *Scale Development: Theory and Applications* (4th Edition).
- D'Innocenzo, L., Mathieu, J. E., & Kukenberger, M. R. (2016). A meta-analysis of different forms of shared leadership–team performance relations. *Journal of Management*, 42(7), 1964-1991.
- Donaldson, S. I., & Grant-Vallone, E. J. (2002). Understanding self-report bias in organizational behavior research. *Journal of business and Psychology*, 17(2), 245-260.
- Dorairaj, S., & Noble, J. (2013). Agile Software Development with Distributed Teams: Agility, Distribution and Trust. In *2013 Agile Conference* (pp. 1–10). IEEE.
- Dorairaj, S., Noble, J., & Malik, P. (2012). Understanding lack of trust in distributed agile teams: a grounded theory study. In *16th International Conference on Evaluation & Assessment in Software Engineering (EASE 2012)* (pp. 81–90).
- Drescher, M. A., Korsgaard, M. A., Welppe, I. M., Picot, A., & Wigand, R. T. (2014). The dynamics of shared leadership: Building trust and enhancing performance. *Journal of Applied Psychology*, 99(5), 771.
- Duarte, D. L., & Snyder, N. T. (2001). *Mastering Virtual Teams: Strategies. Tools and Techniques That Succeed.*

- Dubé, L., & Robey, D. (2009). Surviving the paradoxes of virtual teamwork. *Information systems journal*, 19(1), 3-30.
- Duckworth, H. (2008). How TRW automotive helps global virtual teams perform at the top of their game. *Global Business and Organizational Excellence*, 28(1), 6-16.
- Dulebohn, J. H., & Hoch, J. E. (2017). Virtual teams in organizations. *Human Resource Management Review*, 27, 569–574.
- Eagly, A.H. & Karau, S.J. (1991). Gender and the emergence of leaders: A meta analysis. *Journal of Personality and Social Psychology* 60:685-710.
- Espevik, R., Johnsen, B. H., Eid, J., & Thayer, J. F. (2006). Shared mental models and operational effectiveness: Effects on performance and team processes in submarine attack teams. *Military Psychology*, 18(sup1), S23-S36.
- Fiol, C. M., & O'Connor, E. J. (2005). Identification in face-to-face, hybrid, and pure virtual teams: Untangling contradictions. *Organization Science*, 16, 19-33.
- Fitzgerald, S., & Schutte, N. S. (2010). Increasing transformational leadership through enhancing self-efficacy. *Journal of Management Development*, 29(5), 495-505.
- Fleishman, E. A., Mumford, M. D., Zaccaro, S. J., Levin, K. Y., Korotkin, A. L., & Hein, M. B. (1991). Taxonomic efforts in the description of leader behavior: A synthesis and functional interpretation. *Leadership Quarterly*, 2(4), 245-287.
- Ford, R. C., Piccolo, R. F., & Ford, L. R. (2016). Strategies for building effective virtual teams: Trust is key. *Business Horizons*, 60(1), 25-34.
- Foster, M. K., Abbey, A., Callow, M. A., Zu, X., & Wilbon, A. D. (2015). Rethinking Virtuality and Its Impact on Teams. *Small Group Research*, 46(3), 267–299.
- Gaan, N. (2012). Collaborative tools and virtual team effectiveness: An inductively derived approach in India's software sector. *Decision*, 39(1), 5–27.

- Gibson, C. B. (2001). Me and us: Differential relationships among goal-setting training, efficacy and effectiveness at the individual and team level. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 22(7), 789-808.
- Gibson, C. B., & Cohen, S. G. (Eds.). (2003). *Virtual teams that work. Creating Conditions for Virtual Team Effectiveness*. San Francisco: Jossey-Bass.
- Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*, 51, 451-495.
- Gilson, L. L., Maynard, M. T., Young, N. C. J., Vartiainen, M., & Hakonen, M. (2015). Virtual teams research 10 years, 10 themes, and 10 opportunities. *Journal of Management*, 41,1313–1337.
- Goodman, P. S. (1986). *Designing effective work groups*. San Francisco: Jossey-Bass.
- Guzzo, R. A., & Shea, G. P. (1992). Group performance and intergroup relations in organizations. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 3, pp. 269-313). Palo Alto, CA: Consulting Psychologist Press.
- Hacker, J. V., Johnson, M., Saunders, C., & Thayer, A. L. (2019). Trust in virtual teams: A multidisciplinary review and integration. *Australasian Journal of Information Systems*, 23.
- Hackman, J. R., & Walton, R. E. (1986). Leading groups in organizations. In P. S. Goodman & Associates (Eds.), *Designing effective work groups*. San Francisco: Jossey-Bass.
- Hambrick, D. C., Humphrey, S. E., & Gupta, A. (2015). Structural interdependence within top management teams: A key moderator of upper echelons predictions. *Strategic Management Journal*, 36(3), 449-461.

- Hannah, S. T., Avolio, B. J., Luthans, F., & Harms, P. D. (2008). Leadership efficacy: Review and future directions. *The Leadership Quarterly*, 19(6), 669-692.
- Harrison, D. A., Price, K. H. & Bell, M. P. Beyond relational demography: Time and the effects of surface- and deep-level diversity on work group cohesion. *Academy of Management Journal*, 1998, 41, 96-107.
- Hertel, G., Geister, S., & Konradt, U. (2005). Managing virtual teams: A review of current empirical research. *Human Resource Management Review*, 15(1), 69–95.
- Henttonen, K., & Blomqvist, K. (2005). Managing distance in a global virtual team: the evolution of trust through technology-mediated relational communication. *Strategic Change*, 14(2), 107–119.
- Hill, N. S., & Bartol, K. M. (2016). Empowering leadership and effective collaboration in geographically dispersed teams. *Personnel Psychology*, 69,159–198.
- Hiller, N. J., DeChurch, L. A., Murase, T., & Doty, D. (2011). Searching for Outcomes of Leadership: A 25-Year Review. *Journal of Management*, 37(4), 1137–1177.
- Hinds, P., & Kiesler, S. (Eds.). (2002). *Distributed work*. Cambridge, MA: MIT Press.
- Hinkin, T. R. (1995). A review of scale development practices in the study of organizations. *Journal of management*, 21(5), 967-988.
- Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. *Organizational research methods*, 1(1), 104-121.
- Hoch, J. E., & Dulebohn, J. H. (2013). Shared leadership in enterprise resource planning and human resource management system implementation. *Human Resource Management Review*, 23(1), 114–125.
- Hoch, J. E., & Dulebohn, J. H. (2017). Team personality composition, emergent leadership and shared leadership in virtual teams: A theoretical framework. *Human Resource Management Review*, 27(4), 678–693.

- Hoch, J. E., & Kozlowski, S. W. J. (2014). Leading virtual teams: Hierarchical leadership, structural supports, and shared leadership. *Journal of Applied Psychology*, 99, 390–403.
- Hoch, J. E., Pearce, C. L., & Welzel, L. (2010). Is the Most Effective Team Leadership Shared? The Impact of Shared Leadership, Age Diversity, and Coordination on Team Performance. *Journal of Personnel Psychology*, 9(3), 105–116.
- Hoch, J. E., & Wegge, J. (2014). Shared leadership in virtual teams: The impact of cognitive, affective and behavioural team leadership on team performance.
- Hoegl, M., & Muethel, M. (2016). Enabling Shared Leadership in Virtual Project Teams: A Practitioners' Guide. *Project Management Journal*, 47(1), 7–12.
- Holton, J. A. (2001). Building trust and collaboration in a virtual team. *Team Performance Management*, 7(3), 36-47.
- Horwitz, F. M., Bravington, D., & Silvis, U. (2006). The promise of virtual teams: identifying key factors in effectiveness and failure. *Journal of European Industrial Training*.
- Hoyt, C. L. (2005). The role of leadership efficacy and stereotype activation in women's identification with leadership. *Journal of Leadership & Organizational Studies*, 11(4), 2-14.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55.
- Isaac, C. A., Kaatz, A., & Carnes, M. (2012). Deconstructing the glass ceiling. *Sociology Mind*, 2(01), 80.
- Jarvenpaa, S. L., & Leidner, D. E. (1998). Communication and trust in global virtual teams. *Organization Science*, 10(6), 29–64.
- Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science*, 10(6), 791-815.

- Jarvenpaa, S. L., Shaw, T. R., & Staples, D. S. (2004). Toward contextualized theories of trust: The role of trust in global virtual teams. *Information Systems Research*, 15(3), 250-267.
- Jimenez, A., Boehe, D. M., Taras, V., & Caprar, D. V. (2017). Working Across Boundaries: Current and Future Perspectives on Global Virtual Teams. *Journal of International Management*, 23(4), 341–349.
- Joshi, A., Lazarova, M. and Liao, H. (2009), “Getting everyone on board: the role of inspirational leadership in geographically dispersed teams”, *Organization Science*, Vol. 20 No. 1, pp. 240-252.
- Kaisa, H., & Kirsimarja, B. (2005). Managing distance in a global virtual team: the evolution of trust through technology-mediated relational communication. *Strategic Change*, 14(2), 107.
- Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *The Journal of Strategic Information Systems*, 11(3-4), 187-213.
- Kanawattanachai, P., & Yoo, Y. (2007). The impact of knowledge coordination on virtual team performance over time. *MIS quarterly*, 783-808.
- Kayworth, T. R., & Leidner, D. (2002). Leadership effectiveness in global virtual teams. *Journal of Management Information Systems*, 18, 7–40.
- Kerr, S., & Jermier, J. M. (1978). Substitutes for leadership: Their meaning and measurement. *Organizational behavior and human performance*, 22(3), 375-403.
- Kirkman, B. L., Gibson, C. B., & Kim, K. (2012). Across borders and technologies: Advancements in virtual teams research. In S. W. J. Kozlowski (Ed.), *Oxford handbook of organizational psychology* (Vol. 2, pp. 789–858). New York, NY: Oxford University Press.
- Kirkman, B. L., & Malthieu, J. E. (2005). The dimensions and antecedents of team virtuality. *Journal of Management*, 31, 700–718.

- Kirkman, B. L., Rosen, B., Tesluk, P. E., & Gibson, C. B. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face-interaction. *Academy of Management Journal*, 47, 175–192.
- Kirkman, B. L., Rosen, B., Gibson, C. B., Tesluk, P. E., & McPherson, S. O. (2002). Five challenges to virtual team success: Lessons from Sabre, Inc. *Academy of Management Executive*, 16(3), 67–79.
- Kozlowski, S.W.J. (1998). Training and developing adaptive teams: Theory, principles, and research. In J. A. Cannon-Bowers & E. Salas (Eds.), *Decision making under stress: Implications for training and simulation* (pp. 115-153). Washington, DC: APA Books.
- Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. In *WC Borman, DR Ilgen, & RJ Klimoski (Eds.), Handbook of psychology: Industrial and organizational psychology* (Vol. 12, 333-375).
- Kozlowski, S.W.J., Gully, S. M., McHugh, P. P., Salas, E., & Cannon-Bowers, J. A. (1996a). A dynamic theory of leadership and team effectiveness: Developmental and task contingent leader roles. In G. R. Ferris (Ed.), *Research in personnel and human resource management* (Vol. 14, pp. 253-305). Greenwich, CT: JAI.
- Kozlowski, S. W., Gully, S. M., Salas, E., & Cannon-Bowers, J. A. (1996b). *Team leadership and development: Theory, principles, and guidelines for training leaders and teams*.
- Kozlowski, S.W.J., Gully, S. M., Nason, E. R., & Smith, E. M. (1999). Developing adaptive teams: A theory of compilation and performance across levels and time. In D. R. Ilgen & E. D. Pulakos (Eds.), *The changing nature of work and performance: Implications for staffing, personnel actions, and development* (SIOP Frontiers Series). San Francisco: Jossey-Bass.
- Kozlowski, S.W.J., & Hulst, B.M. (1987). An exploration of climates for technical updating and performance. *Personnel Psychology*, 40, 539–563.
- Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, 7, 77–124.

- Krebs, S. A., Hobman, E. V., & Bordia, P. (2006). Virtual Teams and Group Member Dissimilarity. *Small Group Research*, 37(6), 721–741.
- Kuo, F., & Yu, C. (2009). An Exploratory Study of Trust Dynamics in Work-Oriented Virtual Teams. *Journal of Computer-Mediated Communication*, 14(4), 823–854.
- Lawley, D. (2006). Creating trust in virtual teams at Orange. *Knowledge Management Review*, 9(2), 12.
- Lee, A., & Carpenter, N. C. (2018). Seeing eye to eye: A meta-analysis of self-other agreement of leadership. *The Leadership Quarterly*, 29(2), 253-275.
- Lee-Kelley, L., & Sankey, T. (2008). Global virtual teams for value creation and project success: A case study. *International Journal of Project Management*, 26(1), 51-62.
- Levine, J. M., & Moreland, R. L. (1998). Small groups. In D. T. Gilbert & S. T. Fiske (Eds.), *The handbook of social psychology* (Vol. 2, 4th ed., pp. 4150-4169). Boston, MA: McGraw-Hill.
- Li, Y., Li, H., Mädche, A., & Rau, P.-L. P. (2012). Are you a trustworthy partner in a cross-cultural virtual environment? In *Proceedings of the 4th international conference on Intercultural Collaboration - ICIC '12* (pp. 87–96). New York, New York, USA: ACM Press.
- Lipnack, J., & Stamps, J. (2000). *Virtual teams: People working across boundaries with technology* (2nd ed.). New York, NY: John Wiley.
- Liu, X., Magjuka, R. J., & Lee, S. (2008). An examination of the relationship among structure, trust, and conflict management styles in virtual teams. *Performance Improvement Quarterly*, 21(1), 77–93.
- Locke, E. A. (2003). Leadership: Starting at the top. *Shared leadership: Reframing the hows and whys of leadership*, 271-284.

- Locke, E. A., & Latham, G. P. (1994). Goal setting theory. *Motivation: Theory and research*, 13, 29.
- Lown, J. M. (2011). Development and validation of a financial self-efficacy scale. *Journal of Financial Counseling and Planning*, 22(2), 54.
- Lukić, J., & Vračar, M. (2018). Building and nurturing trust among members in virtual project teams. *Strategic Management*, 23(3), 10–16.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological methods*, 1(2), 130.
- Marlow, S. L., Lacerenza, C. N., & Salas, E. (2017). Communication in virtual teams: A conceptual framework and research agenda. *Human Resource Management Review*, 27(4), 575-589.
- Maruping, L. M., & Agarwal, R. (2004). Managing team interpersonal processes through technology: A task–technology fit perspective. *Journal of Applied Psychology*, 89(6), 975–990.
- Mathieu, J. E., Gallagher, P. T., Domingo, M. A., & Klock, E. A. (2019). Annual Review of Organizational Psychology and Organizational Behavior Embracing Complexity: Reviewing the Past Decade of Team Effectiveness Research. *Annual Review of Organizational Psychology Organ. Behav*, 6, 17–46.
- Mathieu JE, Hollenbeck JR, Knippenberg DV, Ilgen DR. 2017. A century of work teams in the journal of applied psychology. *Journal of Applied Psychology*. 102:452–67.
- Mathieu JE, & Wolfson, MA, Park S. 2018. The evolution of work team research since Hawthorne. *American Psychologist*. 73:308–21.
- Mattarelli, E., & Tagliaventi, M. R. (2010). Work-Related Identities, Virtual Work Acceptance and the Development of Glocalised Work Practices in Globally Distributed Teams. [Article]. *Industry and Innovation*, 17(4), 415-443.

- May, G. L., & Gueldenzoph, L. E. (2006). The effect of social style on peer evaluation ratings in project teams. *Journal of Business Communication*, 43, 4-20.
- Mayer RC and Davis JH (1999) The effect of the performance appraisal system on trust for management: A field quasi-experiment. *Journal of Applied Psychology*. 84(1): 123–136.
- Mayer, R.C., Davis, J.H. and Schoorman, F.D. (1995), “An integrative model of organizational trust”, *Academy of Management Review*, Vol. 20 No. 3, pp. 709-734.
- Maynard, M. T., Mathieu, J. E., Gilson, L. L., Sanchez, D. R., & Dean, M. D. (2019). Do I Really Know You and Does It Matter? Unpacking the Relationship Between Familiarity and Information Elaboration in Global Virtual Teams. *Group & Organization Management*, 44(1), 3–37.
- McAllister, D. J. 1995. Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38: 24–59.
- McCann, J. T. (1990). A multitrait-multimethod analysis of the MCMI-II clinical syndrome scales. *Journal of Personality Assessment*, 55(3-4), 465-476.
- Mccormick, M. J. (2001). Self-efficacy and leadership effectiveness: Applying social cognitive theory to leadership. *Journal of Leadership Studies*, 8(1), 22-33.
- Mccormick, M. J., Tanguma, J., & López-Forment, A. S. (2002). Extending self-efficacy theory to leadership: A review and empirical test. *Journal of Leadership Education*, 1(2), 34-49.
- McGrath, J. E. (1962). *Leadership behavior: Some requirements for leadership training*. Washington, DC: U.S. Civil Service Commission.
- McGrath, J. E. (1991). Time, interaction, and performance (TIP): A theory of groups. *Small Group Research*, 22, 147-174.
- McNab, A. L., Basoglu, K. A., Sarker, S., & Yu, Y. (2012). Evolution of cognitive trust in distributed software development teams: a punctuated equilibrium model. *Electronic Markets*, 22(1), 21–36.

- Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of applied psychology, 94*(2), 535.
- Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American psychologist, 50*(9), 741.
- Montoya, M. M., Massey, A. P., Hung, Y. T. C., & Crisp, C. B. (2009). Can you hear me now? Communication in virtual product development teams. *Journal of Product Innovation Management, 26*(2), 139-155.
- Morris, B. (1998, October 12). The trailblazers: Women of Harvard's MBA Class of '73. *Fortune*, pp. 106-125.
- Morrison, A. (1992). *The new leaders*. San Francisco: Jossey-Bass.
- Muethel M, Gehrlein S, Hoegl M. 2012. Socio-demographic factors and shared leadership behaviors in dispersed teams: implications for human resource management. *Hum. Resource Management. 51*:525–48
- Newell, S., David, G., & Chand, D. (2007). Exploring Trust among Globally Distributed Work Teams. In *2007 40th Annual Hawaii International Conference on System Sciences (HICSS'07)* (p. 246c–246c). IEEE.
- Nicolaides VC, LaPort KA, Chen TR, Tomassetti AJ, Weis EJ, et al. 2014. The shared leadership of teams: a meta-analysis of proximal, distal, and moderating relationships. *Leadership Quarterly. 25*:923–42
- Norman, S. M., Avey, J., Larson, M., & Hughes, L. (2019). The development of trust in virtual leader–follower relationships. *Qualitative Research in Organizations and Management: An International Journal*, (ahead-of-print), 1746–5648.
- Oertig, M., & Buergi, T. (2006). The challenges of managing cross-cultural virtual project teams. *Team Performance Management, 12*(1), 23-30.

- O'Hara-Devereaux, M., & Johansen, R. (1994). *Globalwork: Bridging distance, culture, and time*. San Francisco, CA: Jossey-Bass.
- Paglis, L. L., & Green, S. G. (2002). Leadership self-efficacy and managers' motivation for leading change. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 23(2), 215-235.
- Paul, S., & He, F. (2012). Time Pressure, Cultural Diversity, Psychological Factors, and Information Sharing in Short Duration Virtual Teams. *In 2012 45th Hawaii International Conference on System Sciences* (pp. 149–158). IEEE.
- Pearce, C. L. (2004). The future of leadership: Combining vertical and shared leadership to transform knowledge work. *Academy of Management Perspectives*, 18(1), 47-57.
- Pearce, C. L., & Conger, J. A. (2002). *Shared leadership: Reframing the hows and whys of leadership*. Sage Publications.
- Pearce CL, Sims HP. 2002. Vertical versus shared leadership as predictors of the effectiveness of change management teams: an examination of aversive, directive, transactional, transformational, and empowering leader behaviors. *Group Dynamics: Theory, Res. Pract.* 6:172–97.
- Pierce, J. L., & Gardner, D. G. (2004). Self-esteem within the work and organizational context: A review of the organization-based self-esteem literature. *Journal of Management*, 30(5), 591–622. <https://doi.org/10.1016/j.jm.2003.10.001>
- Pierce, J. L., Gardner, D. G., Cummings, L. L., & Dunham, R. B. (1989). Organization-based self-esteem: Construct definition, measurement, and validation. *Academy of Management Journal*, 32(3), 622-648. doi:http://dx.doi.org.er.lib.k-state.edu/10.2307/256437
- Prussia, G. E., Anderson, J. S., & Manz, C. C. (1998). Self-leadership and performance outcomes: the mediating influence of self-efficacy. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 19(5), 523-538.

- Purvanova, R. K., & Bono, J. E. (2009). Transformational leadership in context: Face-to-face and virtual teams. *The Leadership Quarterly*, 20(3), 343-357.
- Rapp, A., Ahearne, M., Mathieu, J., & Rapp, T. (2010). Managing sales teams in a virtual environment. *International Journal in Marketing Research*, 27, 213-224.
- Robert, L. P., Denis, A. R., & Hung, Y.-T. C. (2009). Individual swift trust and knowledge-based trust in face-to-face and virtual team members. *Journal of Management Information Systems*, 26(2), 241–279.
- Robert, L., & You, S. (2013). Are you satisfied yet? Shared leadership, trust and individual satisfaction in virtual teams.
- Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of statistical software*, 48(2), 1-36.
- RW3 CultureWizard (2016). Trends in global virtual teams report. Retrieved Feb 4, 2020 from <http://info.rw-3.com/virtual-teams-survey-0>
- Salas, E., Tannenbaum, S. I., Kraiger, K., & Smith-Jentsch, K. A. (2012). The Science of Training and Development in Organizations. *Psychological Science in the Public Interest*, 13(2), 74–101. <https://doi.org/10.1177/1529100612436661>
- Sattler, D. N., Kaiser, C. F., & Hittner, J. B. (2000). Disaster Preparedness: Relationships Among Prior Experience, Personal Characteristics, and Distress 1. *Journal of Applied Social Psychology*, 30(7), 1396-1420.
- Schriesheim, C. A., Powers, K. J., Scandura, T. A., Gardiner, C. C., & Lankau, M. J. (1993). Improving construct measurement in management research: Comments and a quantitative approach for assessing the theoretical content adequacy of paper-and-pencil survey-type instruments. *Journal of Management*, 79, 385-417.
- Schwab, D. P. (1980). Construct validity in organization behavior. In B. M. Staw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 2, pp. 3-43). Greenwich, CT: JAI.

- Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. *Measures in health psychology: A user's portfolio. Causal and control beliefs*, 1(1), 35-37.
- Schweitzer, L., & Duxbury, L. (2010). Conceptualizing and measuring the virtuality of teams. *Information Systems Journal*, 20(3), 267-295.
- Scott, M. E. (2013). "Communicate Through the Roof": A Case Study Analysis of the Communicative Rules and Resources of an Effective Global Virtual Team. *Communication Quarterly*, 61(3), 301–318.
- Siebrat, F., Hoegl, M., & Ernst, H. (2009). How to manage virtual teams. *MIT Sloan Management Review*, 50(4), 63—68.
- Siebrat, F., Hoegl, M., & Ernst, H. (2014). Subjective distance and team collaboration in distributed teams. *Journal of Product Innovation Management*, 31(4), 765-779.
- Sivunen, A. (2006). Strengthening Identification with the Team in Virtual Teams: The Leaders' Perspective. *Group Decision and Negotiation*, 15(4), 345.
- Smith, E. M., Ford, J. K., & Kozlowski, S.W.J. (1997). Building adaptive expertise: Implications for training design. In M. A. Quinones & A. Ehrenstein (Eds.), *Training for a rapidly changing workplace: Applications of psychological research* (pp. 89-118). Washington, DC: APA Books.
- Snow, C.C., Snell, S.A., Davison, S.C., & Hambrick, D.C. (1996). Use transnational teams to globalize your company. *Organisational Dynamics*, 24, 50–67.
- Spector, P. E. (2006). Method variance in organizational research: Truth or urban legend? *Organizational Research Methods*, 9(2), 221-232.
- Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological bulletin*, 124(2), 240.
- Staples, D. S., & Webster, J. (2007). Exploring traditional and virtual team members "best practices" a social cognitive theory perspective. *Small group research*, 38(1), 60-97.

- Stark, E. M., & Bierly III, P. E. (2009). An analysis of predictors of team satisfaction in product development teams with differing levels of virtualness. *R&D Management*, 39(5), 461-472.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American psychologist*, 52(6), 613.
- Stone, A.A., Turkkan, J.S., Bachrach, C.A., Jobe, J.B., Kurtzman, H.S. & Cain, V.S. (2000). *The science of self-report: Implications for research and practice*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Taylor, J. A., Davis, A. L., Shepler, L. J., Lee, J., Cannuscio, C., Zohar, D., & Resick, C. (2019). Development and validation of the fire service safety climate scale. *Safety science*, 118, 126-144.
- Thompson, J. D. (1967). *Organizations in action*. New York: McGraw-Hill.
- Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Perspectives*, 12(3), 17-29.
- Van de Ven, A. H., Delbecq, A. L., & Koenig, R. (1976). Determinants of coordination modes within organizations. *American Sociological Review*, 41, 322-328.
- Van Dick, R., Van Knippenberg, D., Hägele, S., Guillaume, Y. R., & Brodbeck, F. C. (2008). Group diversity and group identification: The moderating role of diversity beliefs. *Human Relations*, 61(10), 1463-1492.
- Verburg, R. M., Bosch-Sijtsema, P., & Vartiainen, M. (2013). Getting it done: Critical success factors for project managers in virtual work settings. *International Journal of Project Management*, 31(1), 68–79.
- Wang D, Waldman DA, Zhang Z. 2014. A meta-analysis of shared leadership and team effectiveness. *Journal of Applied Psychology*. 99:181–98.

Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of personality and social psychology*, 56(3), 407.

Zimmermann, P., Wit, A., & Gill, R. (2008). The Relative Importance of Leadership Behaviours in Virtual and Face-to-Face Communication Settings. [Article]. *Leadership*, 4(3), 321-337.

## Appendix A - Tables

**Table 1. Results of the third and final EFA. Total variance explained by each of the 6 factors with eigenvalues > 1 for 47 VLSE items.**

Factor	Initial Eigenvalues			Rotation SS Loadings
	Total	% of Variance	Cumulative %	Total
1	27.15	57.77	57.77	25.60
2	2.26	4.81	62.58	4.14
3	1.27	2.70	65.28	19.68

*Note. Rotation SS loadings = Rotation Sums of Squared Loadings.*

**Table 2. Pattern Matrix for three-factor solution.**

Item	Factor		
	1	2	3
<b>Q2.32</b>	0.928		
<b>Q2.30</b>	0.927		
<b>Q2.25</b>	0.889		
<b>Q2.37</b>	0.876		
<b>Q2.28</b>	0.833		
<b>Q7.123</b>	0.819		
<b>Q2.36</b>	0.813		
<b>Q2.21</b>	0.809		
<b>Q4.66</b>	0.789		
<b>Q4.68</b>	0.785		
<b>Q4.77</b>	0.778		
<b>Q1.10</b>	0.775		
<b>Q1.9</b>	0.745		
<b>Q7.120</b>	0.745		
<b>Q6.94</b>	0.738		
<b>Q1.14</b>	0.735		
<b>Q5.92</b>	0.721		
<b>Q7.126</b>	0.717		
<b>Q6.108</b>	0.712		
<b>Q5.89</b>	0.709		
<b>Q2.38</b>	0.703		
<b>Q4.76</b>	0.693		
<b>Q2.24</b>	0.664		
<b>Q5.91</b>	0.657		
<b>Q1.2</b>	0.639		
<b>Q6.101</b>	0.616		
<b>Q1.18</b>	0.574		
<b>Q3.54</b>	0.518		

Table 2 (Continued)

Q3.40	0.510		0.339
<b>Q6.99</b>	0.503		
Q5.82	0.502		0.380
Q4.65	0.476		0.323
Q6.107	0.439	0.319	
Q6.102	0.424		0.415
Q6.109	0.405		0.363
Q5.85			0.699
Q3.44			0.673
Q5.81			0.642
Q3.50			0.602
Q5.79		-0.312	0.557
Q5.83	0.320		0.548
Q3.43			0.522
Q4.75			0.493
Q3.51		0.333	0.474
Q6.110	0.376		0.464
Q3.42			0.454
Q3.41	0.408		0.434

*Note. Extraction Method: Principal Axis Factoring.*

*Rotation Method: Oblimin with Kaiser Normalization.*

*Loadings < .3 are suppressed. Bolded items were retained.*

**Table 3. Univariate outliers identified for removal prior to the validation analyses. Z cutoff was > |3.29| and Mahalanobis distance critical value was 24.32 (7 variables, p = .001)**

Scale	Univariate Outliers		Multivariate Outliers	
	Participant #	Z	Participant #	Mahalanobis D
VLSE Scale	71	-3.43	171	63.07
	19	-3.43	78	43.77
			194	35.27
			243	30.44
			136	29.34
			23	28.67
			99	28.24
			72	27.33
			182	24.92
VLSE Parallel Form	71	-5.31	243	44.09
			13	38.33
			164	37.29
			163	32.45
			140	26.34
			192	25.54

Table 3 (Continued)			182	25.04
VLSE Trust Scale	236	-4.77	3	24.68
			192	33.47
			149	33.15
			171	32.26
			223	30.04
			26	27.65
			162	24.52

**Table 4. Univariate outliers identified for removal prior to the validation analyses.**

Scale	Participant #	Z
VLSE	71	-3.43
	19	-3.43
VLSE PF	71	-5.31
VLSE Trust	236	-4.69
Functional Diversity	none	n/a
General Diversity	21	3.90
General Self-Efficacy	52	-3.38
Trust in Team	19	-3.30
Organization-Based Self-Esteem	52	-4.25
	204	-3.51
	237	-3.51
Leader Performance	237	-3.91
	66	-3.75
Team Performance	52	-3.41
Task Complexity	19	-3.41

*Note.* Z cutoff > |3.29|.

**Table 5. Results of the reliability analyses and confirmatory factor analyses for the VLSE scale, the VLSE Parallel Form scale, and the VLSE-Trust scale.**

Scale	Reliability	CFA Chi-Square Test of Model Fit		
	$\alpha$	$\chi^2$	df	<i>p</i>
VLSE	.89	12.1	14	.600
VLSE-PF	.87	17.5	14	.231
VLSE-Trust	.83	14.6	9	.102

**Table 6. Means, standard deviations, scale reliabilities, and intercorrelations between variables in study 2.**

	M	SD	$\alpha$	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. VLSE	9.54	1.14	.89	-													
2. VLSE Parallel Form	9.39	1.16	.87	<b>.84</b>	-												
3. VLSE Trust	8.48	1.46	.83	<b>.71</b>	<b>.70</b>	-											
4. Functional Diversity	3.03	0.95	.82	.01	-.02	-.02	-										
5. General Diversity	3.59	0.79	.74	-.07	-.11	-.07	<b>.26</b>	-									
6. General Self-Efficacy	3.44	0.35	.81	<b>.45</b>	<b>.54</b>	<b>.35</b>	.07	-.06	-								
7. Trust in Team	5.83	0.64	.92	<b>.43</b>	<b>.46</b>	<b>.40</b>	.01	<b>-.18</b>	<b>.52</b>	-							
8. Org.-Based Self-Esteem	6.21	0.60	.90	<b>.46</b>	<b>.49</b>	<b>.39</b>	-.02	-.12	<b>.54</b>	<b>.63</b>	-						
9. Leader Performance	4.14	0.49	.94	<b>.50</b>	<b>.47</b>	<b>.40</b>	.03	-.11	<b>.58</b>	<b>.61</b>	<b>.67</b>	-					
10. Team Performance	4.26	0.47	.83	<b>.46</b>	<b>.47</b>	<b>.35</b>	-.02	-.12	<b>.51</b>	<b>.60</b>	<b>.49</b>	<b>.65</b>	-				
11. Task Complexity	4.17	0.55	.80	<b>.42</b>	<b>.38</b>	<b>.30</b>	.09	-.05	<b>.43</b>	<b>.61</b>	<b>.54</b>	<b>.64</b>	<b>.59</b>	-			
12. Leader Experience	8.80	7.21	-	-.06	.09	-.05	-.05	-.05	.11	-.04	.06	.08	.08	.03	-		
13. VT Leader Experience	3.87	2.37	-	<b>.16</b>	.12	.07	-.08	<b>-.14</b>	.12	.08	.11	<b>.17</b>	<b>.20</b>	<b>.15</b>	<b>.20</b>	-	
14. Virtuality	44.08	23.61	-	.01	.03	.07	<b>-.21</b>	<b>-.14</b>	.01	-.07	.02	-.01	.07	-.08	-.02	<b>.22</b>	-
15. Age	40.29	9.63	-	-.04	-.04	-.05	<b>.04</b>	-.01	.01	-.00	.02	.01	-.01	.00	<b>.67</b>	<b>.20</b>	.00

*Note.* Bolded values are significant at  $p < .01$ .

**Table 7. Examination of discriminant validity between OBSE ( $\alpha = .90$ ) and the VLSE scale, the VLSE parallel form, and the VLSE-Trust scale.**

Comparison Scale	$\alpha$	Max possible r with OBSE	r with OBSE	Max Possible Shared Variance between scales	Amount of Shared Variance between scales
VLSE	.87	0.88	0.46	78%	21%
VLSE-PF	.86	0.88	0.49	77%	24%
VLSE-Trust	.80	0.85	0.39	72%	15%

**Table 8. Results of hypothesis 9 using 3 regression analyses to test the moderating effect of task complexity on each of the VLSE scales and leader performance.**

Scale	Comparison		$\Delta R^2$	F	Df	<i>p</i>
VLSE	Model 1	- Model 2	.0023	1.050	1 (241)	.307
VLSE P. Form	Model 1	- Model 2	.0028	1.260	1 (241)	.262
VLSE Trust	Model 1	- Model 2	.0000	0.002	1 (241)	.968

  

Scale	Model	Predictor	Estimate	SE	t	<i>P</i>
VLSE	Model 1	VLSE	0.119	0.022	5.42	<.001
		Task Complexity	0.459	0.046	9.98	<.001
	Model 2	VLSE	-0.023	0.141	-0.164	.870
		Task Complexity	0.129	0.326	0.394	.694
		VLSE x Task Complexity	0.035	0.034	1.024	.307
	VLSE P. Form	Model 1	VLSE PF	0.110	0.021	5.170
Task Complexity			0.477	0.045	10.530	<.001
Model 2		VLSE PF	-0.045	0.139	-.319	.750
		Task Complexity	0.132	0.310	0.424	.672
		VLSE PF x Task Complexity	0.037	0.033	1.124	.262
VLSE Trust		Model 1	VLSE Trust	0.078	0.017	4.670
	Task Complexity		0.504	0.044	11.370	<.001
	Model 2	VLSE Trust	0.082	0.112	0.735	0.463
		Task Complexity	0.513	0.227	2.259	0.025
		VLSE Trust x Task Complexity	-0.001	0.027	-0.041	0.968

**Table 9. Results of hypothesis 10 using 3 regression analyses to test the moderating effect of task complexity on each of the VLSE scales and team performance.**

Scale	Comparison		$\Delta R^2$	F	Df	<i>p</i>
VLSE	Model 1	- Model 2	.00000	0.0014	1 (241)	.970
VLSE P. Form	Model 1	- Model 2	.00150	0.6190	1 (241)	.432
VLSE Trust	Model 1	- Model 2	.00428	1.6800	1 (241)	.196
Scale	Model	Predictor	Estimate	SE	t	<i>p</i>
<b>VLSE</b>						
	Model 1	VLSE	0.105	0.023	4.680	<.001
		Task Complexity	0.411	0.047	8.730	<.001
	Model 2	VLSE	0.111	0.144	0.766	.444
		Task Complexity	0.424	0.335	1.267	.207
		VLSE x Task Complexity	-0.001	0.035	-0.037	.970
<b>VLSE P. Form</b>						
	Model 1	VLSE PF	0.115	0.021	5.370	<.001
		Task Complexity	0.412	0.046	9.070	<.001
	Model 2	VLSE PF	0.224	0.140	1.598	0.111
		Task Complexity	0.655	0.312	2.099	0.037
		VLSE PF x Task Complexity	-0.026	0.033	-0.787	0.432
<b>VLSE Trust</b>						
	Model 1	VLSE Trust	0.063	0.017	3.700	<.001
		Task Complexity	0.455	0.045	10.020	<.001
	Model 2	VLSE Trust	0.209	0.114	1.835	0.068
		Task Complexity	0.750	0.232	3.234	0.001
		VLSE Trust x Task Complexity	-0.035	0.027	-1.297	0.196

**Table 10. Results of hypothesis 11 using 3 regression analyses to test the moderating effect of virtuality on each of the VLSE scales and leader performance.**

Scale	Comparison		$\Delta R^2$	F	Df	<i>p</i>
VLSE	Model 1	- Model 2	.00291	0.939	1 (241)	.334
VLSE P. Form	Model 1	- Model 2	.00900	2.800	1 (241)	.095
VLSE Trust	Model 1	- Model 2	.00404	1.17	1 (241)	.281
Scale	Model	Predictor	Estimate	SE	t	<i>p</i>
<b>VLSE</b>						
	Model 1	VLSE	0.212	0.024	8.966	<.001
		Virtuality	0.000	0.0001	-0.277	.782
	Model 2	VLSE	0.254	0.049	5.158	<.001
		Virtuality	0.008	0.009	0.924	0.356

Table 10 (Continued)

		VLSE x Virtuality	0.001	0.001	-0.969	0.334
<b>VLSE P. Form</b>		<hr/>				
Model 1	VLSE PF	0.195	0.024	8.192	<.001	
	Virtuality	0.000	0.001	-0.359	.720	
Model 2	VLSE PF	0.266	0.048	5.490	<.001	
	Virtuality	0.014	0.008	1.610	.109	
	VLSE PF x Virtuality	-0.002	0.001	-1.970	.095	
<b>VLSE Trust</b>		<hr/>				
Model 1	VLSE Trust	0.134	0.020	6.825	<.001	
	Virtuality	0.001	0.001	-0.623	.534	
Model 2	VLSE Trust	0.175	0.042	4.123	<.001	
	Virtuality	0.006	0.006	0.944	.346	
	VLSE Trust x Virtuality	0.001	0.001	-1.080	.281	

**Table 11. Results of hypothesis 12 using 3 regression analyses to test the moderating effect of virtuality on each of the VLSE scales and team performance.**

Scale	Comparison		$\Delta R^2$	F	Df	<i>p</i>
VLSE	Model 1	- Model 2	.00004	0.0149	1 (241)	.903
VLSE P. Form	Model 1	- Model 2	.00066	0.2050	1 (241)	.651
VLSE Trust	Model 1	- Model 2	.00151	0.4180	1 (241)	.518
Scale	Model	Predictor	Estimate	SE	t	<i>P</i>
<hr/>						
<b>VLSE</b>						
	Model 1	VLSE	0.188	0.023	8.06	<.001
		Virtuality	0.001	0.001	1.04	.301
	Model 2	VLSE	0.183	0.049	3.761	<.001
		Virtuality	0.000	0.009	0.015	.988
		VLSE x Virtuality	0.000	0.001	0.122	.903
<hr/>						
<b>VLSE P. Form</b>						
	Model 1	VLSE PF	0.188	0.023	8.197	<.001
		Virtuality	0.001	0.001	0.943	0.347
	Model 2	VLSE PF	0.206	0.047	4.411	<.001
		Virtuality	0.005	0.008	0.579	.563
		VLSE PF x Virtuality	0.000	0.001	-0.453	.651
<hr/>						
<b>VLSE Trust</b>						
	Model 1	VLSE Trust	0.113	0.019	5.815	<.001
		Virtuality	0.001	0.001	0.679	.498
	Model 2	VLSE Trust	0.137	0.042	3.266	.001

Table 11 (Continued)

Virtuality	0.005	0.006	0.762	.447
VLSE Trust x Virtuality	0.000	0.001	-0.647	.518

---

# **Appendix B - Scales for Study 1**

## **Informed Consent to Participate in the Study**

KANSAS STATE UNIVERSITY INFORMED CONSENT

PROJECT TITLE: Virtual Leader Self-Efficacy: A Scale Development Study

APPROVAL DATE OF PROJECT: 07/31/2020

PRINCIPAL INVESTIGATOR: Dr. Patrick Knight

CO-INVESTIGATORS: Kelsey Couture

CONTACT FOR ANY PROBLEMS/ QUESTIONS: Kelsey Couture, Graduate Research Assistant, 562 Bluemont Hall, Kansas State University, Manhattan, KS 66506, kelseylen@ksu.edu

IRB CHAIR CONTACT/PHONE INFORMATION: Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224 Cheryl Doerr, Associate Vice President for Research Compliance, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224

PURPOSE OF THE RESEARCH: The purpose of this study is to gain a better understanding of how to measure virtual leadership self-efficacy.

PROCEDURES OR METHODS TO BE USED: You will be presented with some individual differences (e.g., confidence) and workplace (e.g., performance, trust) measures and will be asked to provide your thoughts and feelings on this information. You will also be presented with some basic behavioral and demographic questions.

LENGTH OF STUDY: About 10 minutes

RISKS ANTICIPATED: The risks of this study are no different from those that would be expected to occur in everyday life.

BENEFITS ANTICIPATED: Although there are no benefits to participating, this information can help researchers better understand the relationships that exist between factors like virtual leadership, performance, and work-life balance, and how they come together to influence worker behavior and decision-making.

EXTENT OF CONFIDENTIALITY: We will not ask for any personal information such as name or employer. Responses to this survey will only be presented in aggregate form, such that individual responses cannot be identified.

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that by clicking the arrow button below, that I have read and understood this consent form and willingly agree to participate in this study under the terms described. I may print a copy of this form for my records if desired.

### **General Survey Instructions**

You have been selected for this survey due to your experience leading virtual teams. Teams work together to achieve their work goals, and virtual teams use technology to work together when face-to-face contact is not feasible. They come in a variety of forms. Some virtual teams are completely virtual and never meet face-to-face. Others might work virtually about half the time, and they work together in person the other half of the time. Both synchronous communication methods (methods like video calls that allow you to talk to each other in real time) and asynchronous methods (email, listservs, etc. that have a delay) help virtual teams function effectively.

While completing the survey, please answer the questions relative to leading virtual teams rather than strictly face-to-face teams.

### **Calibration Items**

To familiarize yourself with the rating form used throughout the survey, please complete this practice item first.

If you were asked to lift objects of different weights right now, how certain are you that you can lift each of the weights described below?

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

#### *Rating Scale*

*1 = 0% (Completely certain I cannot do it at all)*

*2 = 10%*

- 3 = 20%
- 4 = 30%
- 5 = 40%
- 6 = 50% (*Moderately certain I can do it*)
- 7 = 60%
- 8 = 70%
- 9 = 80%
- 10 = 90%
- 11 = 100% (*Completely certain I can do it*)

Items:

1. 10-pound object
2. 20-pound object
3. 50-pound object
4. 100-pound object
5. 200-pound object
6. 3600-pound object

### **VLSE Scale Instructions**

Listed on the next page are a variety of virtual leader behaviors. If you were asked to execute these virtual leader behaviors in your virtual team right now, how confident are you that you could successfully perform them?

Please rate your degree of confidence by recording a number from 0 to 100 using the scale provided.

For example, if you are certain you cannot do it at all, choose 0% since you have no confidence in your ability. If you are certain you can do it, choose 100% since you have 100% confidence in your ability.

*Rating Scale*

*1 = 0% (Completely certain I cannot do it at all)*

2 = 10%

3 = 20%

4 = 30%

5 = 40%

6 = 50% (*Moderately certain I can do it*)

7 = 60%

8 = 70%

9 = 80%

10 = 90%

11 = 100% (*Completely certain I can do it*)

1. Develop high quality virtual team communication standards.
2. Effectively implement communication standards in my virtual team.
3. Hold my virtual team accountable for high quality communication.
4. Teach my virtual team what high quality communication looks like in a virtual setting.
5. Demonstrate high quality communication with my virtual team members.
6. Provide feedback to virtual team members on their communication quality.
7. Help my virtual team communicate more effectively.
8. Maintain high quality communication when my virtual team cannot meet face to face.
9. Determine procedures that help my virtual team communicate effectively.
10. Enhance the clarity of my virtual team's communication.
11. Hold virtual team members accountable for high-quality communication expectations.
12. Train my virtual team to communicate better together.
13. Assist my virtual team in communicating better together.
14. Develop methods that make clear virtual team communication easier.
15. Address situations that indicate a need for better virtual team communication.

16. Help my virtual team communicate more clearly.
17. Remove barriers to high quality virtual team communication.
18. Resolve problems preventing high quality virtual team communication.
19. Identify problems preventing high quality virtual team communication.
20. Motivate virtual team members to communicate more effectively.
21. Know the advantages and disadvantages of each communication medium.
22. Know the benefits of using each communication method (video call, chat, email, listserv, etc.).
23. Know the disadvantages of using different communication methods.
24. Understand the repercussions of choosing different communication methods.
25. Choose the correct communication method depending on message content.
26. Select the correct communication method depending on the message content.
27. Understand the implications of using different communication methods.
28. Use the right communication method to relay sensitive information to my virtual team members.
29. Choose the best communication method to allow for virtual team collaboration.
30. Use synchronous communication methods for the right situations (ex: phone calls and video calls).
31. Use asynchronous communication methods in the appropriate situations (ex: email, chat, listserv).
32. Choose the right communication method to send urgent information.
33. Choose the right communication method for exchanging general, non-urgent information.

34. Utilize the best communication method to share emotional information to my virtual team members.
35. Understand when some communication methods are better to use than others for my virtual team.
36. Select the best communication method for giving bad news to a virtual team member.
37. Pick the most efficient communication method to gain consensus on a topic among virtual team members.
38. Choose the best communication method to have a difficult conversation.
39. Select the appropriate communication method to reduce the chance of misunderstandings.
40. Build trust among virtual team members.
41. Enhance each virtual team member's trust in me.
42. Repair trust in my virtual team.
43. Identify mistrust among virtual team members.
44. Recognize when virtual team members do not trust me.
45. Develop trust with each virtual team member.
46. Develop trust in my virtual team.
47. Develop trust between virtual team members.
48. Be seen as trustworthy by my virtual team members.
49. Resolve virtual team conflict in a manner that repairs trust.
50. Mend relationships with virtual team members who do not trust me.
51. Mend virtual team member relationships to restore trust.
52. Improve trust in my virtual team.

53. Improve my trust in my virtual team.
54. Improve my virtual team member's trust in me.
55. Enhance my trust in each of my virtual team members.
56. Maximize trust in my virtual team.
57. Build trust in my virtual team when face-to-face contact is not feasible.
58. Improve my virtual team's trust in me when face-to-face contact is not feasible.
59. Mend relationships with virtual team members I do not trust.
60. Develop mutual trust in my virtual team.
61. Maximize the clarity of virtual team members' roles.
62. Ensure the clarity of virtual team goals.
63. Make my virtual team members' roles predictable.
64. Reduce feelings of uncertainty in my virtual team.
65. Mitigate uncertainty in the virtual team.
66. Help virtual team members understand everyone's role.
67. Define each virtual team member's role explicitly.
68. Enhance role clarity among virtual team members.
69. Reduce job ambiguity among the virtual team members.
70. Maximize role clarity among virtual team members.
71. Enhance the clarity of virtual team members' roles.
72. Reduce feelings of unpredictability in my virtual team.
73. Reduce uncertainty in my virtual team
74. Make my virtual team members' goals more clear.
75. Mitigate unpredictability in the virtual team.

76. Define each virtual team members' goals explicitly.
77. Make my virtual team members' roles clear.
78. Give decision-making authority to my virtual team members.
79. Allow virtual team members to make decisions without my approval.
80. Teach virtual team members how to make decisions without me.
81. Let virtual team members monitor their own performance.
82. Develop my virtual team's ability to regulate their own performance.
83. Develop my virtual team's ability to collaborate together without my oversight.
84. Empower each virtual team member to take control of their own job tasks.
85. Let go of control over my virtual team's tasks.
86. Develop virtual team member's ability to take control of their tasks.
87. Make each virtual team member feel they have decision-making authority.
88. Motivate each virtual team member to take action when they see an opportunity to utilize their skills.
89. Empower each virtual team member to take action when they see an opportunity to utilize their skills.
90. Give my virtual team members responsibility for their tasks.
91. Give my virtual team members control over their tasks.
92. Allow virtual team members to make decisions together.
93. Teach virtual team members to take control of their tasks.
94. Identify virtual team processes that need more structure.
95. Implement protocols when needed.
96. Recognize when protocols are needed.

97. Organize virtual team information effectively.
98. Develop a method for organizing information the virtual team needs.
99. Ensure virtual team members are incentivized in their role.
100. Ensure the virtual team member is compensated for their virtual team work.
101. Recognize whether virtual team members are properly rewarded for their effort.
102. Determine whether members are incentivized to work hard as virtual team members.
103. Recognize whether the organization disincentivizes virtual team effort.
104. Determine whether virtual team members are properly motivated.
105. Determine whether virtual team members are rewarded for their effort.
106. Enhance the virtual team's motivation to work hard.
107. Enhance the virtual team's motivation to improve.
108. Determine whether virtual team members are properly rewarded for their effort.
109. Recognize whether members are incentivized to work hard as virtual team members.
110. Build the virtual team's motivation to improve.
111. Build the virtual team's motivation to work hard.
112. Recognize which team members spend more time working virtually compared to others.
113. Determine how interdependent my virtual team members are.
114. Understand how my leadership effectiveness is impacted by virtuality.
115. Identify how interdependent my virtual team's tasks are.
116. Adapt my leadership style to team members who are completely virtual.
117. Adapt my leadership style when virtual team tasks are completely interdependent.
118. Determine differences in levels of virtuality among team members.

119. Determine how often my virtual team works face-to-face.
120. Customize my leadership style to the characteristics of my virtual team.
121. Know how team virtuality requires customized leadership.
122. Determine the interdependence of my virtual team's goals.
123. Recognize the interdependence of my virtual team's tasks.
124. Recognize how virtual my team is.
125. Determine how virtual my team is.
126. Identify how virtual my team is.

### **Demographic Information**

1. Please indicate your current employment status. \_\_\_\_\_
2. Please enter your age in years. \_\_\_\_\_
3. Please indicate your sex/gender. \_\_\_\_\_
4. Please select the race/ethnicity that you most identify with. \_\_\_\_\_
5. Please select your industry. \_\_\_\_\_
6. What is the highest level of school you have completed or the highest degree you have received? \_\_\_\_\_
7. How many years have you been a supervisor? \_\_\_\_\_
8. How many years of experience do you have working with virtual teams. \_\_\_\_\_
9. How many people are on your virtual team? \_\_\_\_\_
10. What percent of time does your virtual team spend working face-to-face? \_\_\_\_\_

### **Debriefing Statement**

Thank you for participating in this research study! Your responses will allow us to take a deeper look at how a leader's belief in their ability to be a virtual leader impacts important work outcomes. We specifically wanted to examine how to best measure this level of confidence. If you have any questions please feel free to contact the project investigators.

## **Appendix C - Scales for Study 2**

### **Informed Consent to Participate in the Study**

KANSAS STATE UNIVERSITY INFORMED CONSENT

PROJECT TITLE: Virtual Leader Self-Efficacy: A Scale Development Study

APPROVAL DATE OF PROJECT: 07/31/2020

PRINCIPAL INVESTIGATOR: Dr. Patrick Knight

CO-INVESTIGATORS: Kelsey Couture

CONTACT FOR ANY PROBLEMS/ QUESTIONS: Kelsey Couture, Graduate Research Assistant, 562 Bluemont Hall, Kansas State University, Manhattan, KS 66506, kelseylen@ksu.edu

IRB CHAIR CONTACT/PHONE INFORMATION: Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224 Cheryl Doerr, Associate Vice President for Research Compliance, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224

PURPOSE OF THE RESEARCH: The purpose of this study is to gain a better understanding of how to measure virtual leadership self-efficacy.

PROCEDURES OR METHODS TO BE USED: You will be presented with some individual differences (e.g., confidence) and workplace (e.g., performance, trust) measures and will be asked to provide your thoughts and feelings on this information. You will also be presented with some basic behavioral and demographic questions.

LENGTH OF STUDY: About 10 minutes

RISKS ANTICIPATED: The risks of this study are no different from those that would be expected to occur in everyday life.

BENEFITS ANTICIPATED: Although there are no benefits to participating, this information can help researchers better understand the relationships that exist between factors like virtual leadership, performance, and work-life balance, and how they come together to influence worker behavior and decision-making.

EXTENT OF CONFIDENTIALITY: We will not ask for any personal information such as name or employer. Responses to this survey will only be presented in aggregate form, such that individual responses cannot be identified.

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that by clicking the arrow button below, that I have read and understood this consent form and willingly agree to participate in this study under the terms described. I may print a copy of this form for my records if desired.

## General Survey Instructions

You have been selected for this survey due to your experience leading virtual teams. Teams work together to achieve their work goals, and virtual teams use technology to work together when face-to-face contact is not feasible. They come in a variety of forms. Some virtual teams are completely virtual and never meet face-to-face. Others might work virtually about half the time, and they work together in person the other half of the time. Both synchronous communication methods (methods like video calls that allow you to talk to each other in real time) and asynchronous methods (email, listservs, etc. that have a delay) help virtual teams function effectively.

While completing the survey, please answer the questions relative to leading virtual teams rather than strictly face-to-face teams.

## Calibration Items

To familiarize yourself with the rating form used throughout the survey, please complete this practice item first.

If you were asked to lift objects of different weights right now, how certain are you that you can lift each of the weights described below?

Rate your degree of confidence for each item by recording a number from 0 to 100 using the scale given below:

### *Rating Scale*

*1 = 0% (Completely certain I cannot do it at all)*

*2 = 10%*

*3 = 20%*

*4 = 30%*

*5 = 40%*

*6 = 50% (Moderately certain I can do it)*

*7 = 60%*

*8 = 70%*

*9 = 80%*

*10 = 90%*

*11 = 100% (Completely certain I can do it)*

1. 10-pound object
2. 20-pound object
3. 50-pound object
4. 100-pound object
5. 200-pound object
6. 3600-pound object

### **VLSE Scale Instructions (for all three scales)**

Listed on the next few pages are a variety of virtual leader behaviors. If you were asked to execute these virtual leader behaviors in your virtual team right now, how confident are you that you could successfully perform them?

Please rate your degree of confidence by recording a number from 0 to 100 using the scale provided.

For example, if you are certain you cannot do it at all, choose 0% since you have no confidence in your ability. If you are certain you can do it, choose 100% since you have 100% confidence in your ability.

#### *Rating Scale*

*1 = 0% (Completely certain I cannot do it at all)*

*2 = 10%*

*3 = 20%*

*4 = 30%*

*5 = 40%*

*6 = 50% (Moderately certain I can do it)*

*7 = 60%*

*8 = 70%*

*9 = 80%*

*10 = 90%*

*11 = 100% (Completely certain I can do it)*

### **VLSE Scale Items**

1. Enhance the clarity of my virtual team's communication.
2. Choose the correct communication method depending on message content.
3. Improve my virtual team member's trust in me.
4. Help virtual team members understand everyone's role.
5. Empower each virtual team member to take action when they see an opportunity to utilize their skills.
6. Identify virtual team processes that need more structure.
7. Customize my leadership style to the characteristics of my virtual team.

### **VLSE Parallel Form Items**

1. Improve my virtual team member's trust in me.
2. Develop methods that make clear virtual team communication easier.
3. Know the advantages and disadvantages of each communication medium.
4. Make my virtual team members' roles clear.
5. Give my virtual team members control over their tasks.
6. Ensure virtual team members are incentivized in their role.
7. Recognize the interdependence of my virtual team's tasks.

### **VLSE Trust Scale Items**

1. Repair trust in my virtual team.
2. Identify mistrust among virtual team members.

3. Recognize when virtual team members do not trust me.
4. Mend relationships with virtual team members who do not trust me.
5. Mitigate unpredictability in the virtual team.
6. Let virtual team members monitor their own performance.
7. Let go of control over my virtual team's tasks. (note: this item was removed from the final scale)

### **Functional Diversity**

Some teams consist of employees who all come from the same background, and share the same knowledge and expertise. Others consist of team members with a variety of backgrounds, experiences, and knowledge. Think about your virtual team, then please indicate how varied your team is with regard to each person's background, knowledge, and experience.

#### *Rating Scale*

*1 = All members have the same knowledge and experiences .*

*2 = Most members have the same knowledge and experiences.*

*3 = About half have unique and half have the same knowledge and experiences.*

*4 = Most members have unique knowledge and experiences.*

*5 = Each member has unique knowledge and experiences*

1. To what extent do members of this virtual team possess distinct functional knowledge or expertise? (e.g., marketing, finance, accounting, management)
2. To what extent are different virtual team members' work experiences (e.g., function, industry) distinct from one another? Work experience includes internships, part-time and full-time employment.
3. To what extent do virtual team members differ in the knowledge or expertise they draw on for team projects?

## General Diversity

Think of your virtual team. Please rate how similar or different your team members are regarding the following characteristics.

### *Rating Scale*

*1 = Completely similar*

*2 = Almost completely similar*

*3 = Mostly similar*

*4 = About half are similar and half are different*

*5 = Mostly different*

*6 = Almost completely different*

*7 = Completely different*

1. Age
2. Gender
3. Ethnic background
4. Educational background
5. Personal values
6. Attitudes about work
7. Learning goals
8. How diverse do you think your virtual team is in general? (Note: for this item, the word “different” was changed to “diverse” in the response scale)

## Generalized Self-Efficacy (GSE)

Below are statements that describe how you may think about yourself right now. Use the following scale to indicate your level of agreement or disagreement with each statement.

### *Rating Scale*

*1 = Not True At All*

*2 = Hardly True*

*3 = Moderately True*

*4 = Exactly True*

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

### **Leader Trust in the Team**

Please use the prompt below and rate the extent to which you agree with each of the following items.

#### *Rating Scale*

*1 = Strongly disagree*

*2 = Disagree*

*3 = Somewhat disagree*

*4 = Neither agree nor disagree*

*5 = Somewhat agree*

*6 = Agree*

*7 = Strongly agree*

“I trust that my virtual team members...”

1. ...Are completely honest with me.
2. ...Place our organization’s interests above their own.

3. ...Will keep the promises that they make.
4. ...Are competent in performing their jobs.
5. ...Express their true feelings about important issues.
6. ...Care about my well-being.
7. ...Can contribute to our organization's success.
8. ...Take actions that are consistent with their words.
9. ...Share important information with me.
10. ...Care about the future of our organization.
11. ...Can help solve important problems in our organization.
12. ...Have consistent expectations of me.
13. ...Would make personal sacrifices for our organization.
14. ...Would acknowledge their own mistakes.
15. ...Can help our organization survive through the 2020s.
16. ...Can be relied on.

### **Organization-Based Self-Esteem**

Think about the messages you receive from the attitudes and behaviors of your own managers and supervisors, then rate your agreement with the following statements.

#### *Rating Scale*

*1 = Strongly disagree*

*2 = Disagree*

*3 = Somewhat disagree*

*4 = Neither agree nor disagree*

*5 = Somewhat agree*

*6 = Agree*

*7 = Strongly agree*

1. I count around here.
2. I am taken seriously around here.
3. I am important around here.
4. I am trusted around here.
5. There is faith in me around here.
6. I can make a difference around here.
7. I am valuable around here.
8. I am helpful around here.
9. I am efficient around here.
10. I am cooperative around here.

### **Self-Rated Leader Performance**

Please rate how well this statement describes your behavior as a leader.

#### *Rating Scale*

*1 = Does not describe me*

*2 = Describes me slightly well*

*3 = Describes me moderately well*

*4 = Describes me very well*

*5 = Describes me extremely well*

1. Effectively communicates information and ideas to virtual team members.
2. Engages in frequent open communication with all virtual team members.
3. Clearly expresses ideas, thoughts, and directions in written communication to virtual team members.
4. Clearly understands all written communication passed among the virtual team.
5. Adapts real-time to changing work demands impacting the virtual team.

6. Identifies strengths and weaknesses of different strategies for achieving a virtual team goal.
7. Determines when it is necessary to reconcile virtual team member differences.
8. Promotes shared goal commitment among team members.
9. Mediates conversations between virtual team members who disagree.
10. Develops a team culture that enables virtual team members to thrive.
11. Implements appropriate strategies to enhance virtual teamwork.
12. Motivates your virtual team members to work hard.
13. Develops your virtual team members to improve their success.
14. Creates an environment where teamwork is valued.
15. Allocates financial resources appropriately in your virtual team.
16. Manages the equipment, facilities, and materials the virtual team needs.
17. Enables opportunities for successful team performance.
18. Adapts your leadership style to the characteristics of the virtual team.
19. Vigilantly monitors progress towards team goals.
20. Diagnoses deficiencies in need of improvement in the virtual team.
21. Identifies impending environmental changes that will impact the virtual team.
22. Identifies barriers to virtual team success.
23. Effectively gathers information to identify the nature of a problem.
24. Implements effective solutions to problems.

### **Leader-Rated Team Performance**

Please think about your virtual team's performance during the past year. In relation to other teams you have led, how does your virtual team rate on each of the following factors?

*Rating Scale*

*1 = Terrible*

*2 = Poor*

*3 = Average*

*4 = Good*

*5 = Excellent*

1. The quantity or amount of work produced.
2. The number of innovations or new ideas introduced by the team.
3. Reputation for work excellence.
4. Attainment of team production or service goals.
5. The quality or accuracy of work.
6. Efficiency of team operations.
7. Morale of team personnel.
8. Adherence to schedule and budget.

### **Leader Task Complexity**

Please think of how your virtual team members work together, then rate how well each of the items describe your virtual team.

*Rating Scale*

*1 = Does not describe my team*

*2 = Describes my team slightly well*

*3 = Describes my team moderately well*

*4 = Describes my team very well*

*5 = Describe my team extremely well*

1. Virtual team members must coordinate their efforts with each other.
2. Goal attainment for one virtual team member helps goal attainment for others.
3. For the team to perform well, virtual team members must communicate well.

4. To achieve high performance, it is important for virtual team members to rely on each other.
5. Jobs performed by different virtual team members are related to one another.
6. Success for one virtual team member implies success for others.

## **Work Arrangement**

Please think of how your virtual team members work together, then rate how well each of the items describe your virtual team.

### *Rating Scale*

- 1 = Does not describe my team*
- 2 = Describes my team slightly well*
- 3 = Describes my team moderately well*
- 4 = Describes my team very well*
- 5 = Describe my team extremely well*

1. Work activities are separately conducted, then all team members combine their contribution into the final product.
2. Work flows from one individual to another unidirectionally over time.
3. Work is exchanged between team members back and forth, one by one, over time.
4. All team members simultaneously work to solve the problem or collaborate on the task.

## **Leadership Experience**

1. How many years have you been a supervisor? \_\_\_\_\_
2. How many years of experience do you have working with virtual teams?

### *Rating Scale*

- 1 = less than 1 year*
- 2 = 1 - 2 years*

- 3 = 3 - 4 years
- 4 = 5 - 6 years
- 5 = 7 - 8 years
- 6 = 9 - 10 years
- 7 = 11 - 12 years
- 8 = 13 - 14 years
- 9 = 15 - 16 years
- 10 = 17 - 18 years
- 11 = 19 - 20 years
- 12 = More than 20 years

### **Virtual Team Characteristics**

1. How many people are on your virtual team? \_\_\_\_\_
2. What percent of time does your virtual team spend working face-to-face? \_\_\_\_\_

Please rate how well these items describe your interactions with your virtual team members.

#### *Rating Scale*

- 1 = *Strongly disagree*
- 2 = *Disagree*
- 3 = *Somewhat disagree*
- 4 = *Neither agree nor disagree*
- 5 = *Somewhat agree*
- 6 = *Agree*
- 7 = *Strongly agree*

1. I see some team members in person more than others.
2. I have never met some of my team members in person.
3. I see all of my team members in person monthly.
4. I see all my team members in person daily.
5. My team spans multiple time zones.

6. I see all of my team members in person at least yearly.

### **Demographic Information**

1. Please indicate your current employment status. \_\_\_\_\_
2. Please enter your age in years. \_\_\_\_\_
3. Please indicate your sex/gender. \_\_\_\_\_
4. Please select the race/ethnicity that you most identify with. \_\_\_\_\_
5. Please select your industry. \_\_\_\_\_
6. What is the highest level of school you have completed or the highest degree you have received? \_\_\_\_\_

### **Debriefing Statement**

Thank you for participating in this research study! Your responses will allow us to take a deeper look at how a leader's belief in their ability to be a virtual leader impacts important work outcomes. We specifically wanted to examine how to best measure this level of confidence. If you have any questions please feel free to contact the project investigators.

## Appendix D - Virtual Leader Performance Scale Framework

The self-rated Leader Performance Measure breakdown is shown below. The Leadership Skills Strataplex dimensions and items are shown on the left, and the corresponding items written for study 2 are shown on the right. Items were based on Bell and Kozlowski's (2002) taxonomy of virtual teams.

<i>Leadership Skills Dimensions and Items</i>	<i>Leader Performance Items</i>
<i>Cognitive Skill Requirements</i>	
<i>Speaking</i> (talking to others to convey information effectively)	1. Effectively communicates information and ideas to virtual team members.
<i>Active Listening</i> (listening to what other people are saying and asking questions as appropriate)	2. Engages in frequent open communication with all virtual team members.
<i>Writing</i> (communicating effectively in writing as appropriate for the needs of the audience)	3. Clearly expresses ideas, thoughts, and directions in written communication to my virtual team.
<i>Reading Comprehension</i> (understanding written sentences and paragraphs in work related documents)	4. Clearly understands all written communication passed among the virtual team.
<i>Active Learning</i> (working with new information to grasp its implications)	5. Adapts real-time to changing work demands impacting the virtual team.
<i>Critical Thinking</i> (using logic and analysis to identify the strengths and weaknesses of different approaches).	6. Identifies strengths and weaknesses of different strategies for achieving a virtual team goal.
<i>Interpersonal Skill Requirements</i>	
<i>Social Perceptiveness</i> (being aware of others' reactions and understanding why they react as they do)	7. Determines when it is necessary to reconcile virtual team member differences.
<i>Coordination</i> (adjusting actions in relation to others' actions)	8. Promotes shared goal commitment among team members.
<i>Negotiation</i> (bringing others together to reconcile differences)	9. Mediates conversations between virtual team members who disagree.

*Persuasion*  
(persuading others to change their minds or behavior)

10. Develops a team culture that enables virtual team members to thrive.

---

*Business Skill Requirements*

---

*Operations Analysis*  
(analyzing needs and product requirements to create a design)

11. Implements appropriate strategies to enhance virtual teamwork.

*Management Of Personnel Resources*  
(motivating, developing, and directing people as they work)

12. Motivates your virtual team members to work hard.

Note: these three items will be assessed for high correlations then aggregated if appropriate.

13. Develops your virtual team members to improve their success.

14. Creates an environment where teamwork is valued.

*Management Of Financial Resources*  
(determining how money will be spent to get the work done)

15. Allocates financial resources appropriately in your virtual team.

*Management Of Material Resources*  
(obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work)

16. Manages the equipment, facilities, and materials the virtual team needs.

---

*Strategic skill requirements*

---

*Visioning*  
(developing an image of how a system should work under ideal conditions)

17. Enables opportunities for successful team performance.

*Systems Perception*  
(determining when important changes have occurred in a system or are likely to occur)

18. Vigilantly monitors progress towards team goals.

*System Evaluation*  
(looking at many indicators of system performance, taking into account their accuracy)

19. Diagnoses deficiencies in need of improvement in the virtual team.

*Identification Of Downstream Consequences*  
(determining the long-term outcomes of a change in operations)

20. Identifies impending environmental changes that will impact the virtual team.

*Identification Of Key Causes*  
(identifying the things that must be changed to achieve a goal)

21. Identifies barriers to virtual team success.

*Problem Identification*  
(identifying the nature of problems)

*Solution Appraisal*  
(observing and evaluating the outcomes of  
problem solution to identify lessons learned or  
redirect efforts)

22. Effectively gathers information to  
identify the nature of a problem.

23. Implements effective solutions to  
problems.

## **Appendix E - VLSE Scale, VLSE Parallel Form, and VLSE Trust**

### **Scale Items and Instructions**

#### **VLSE Scale Instructions (for all three scales)**

Listed on the next few pages are a variety of virtual leader behaviors. If you were asked to execute these virtual leader behaviors in your virtual team right now, how confident are you that you could successfully perform them?

Please rate your degree of confidence by recording a number from 0 to 100 using the scale provided.

For example, if you are certain you cannot do it at all, choose 0% since you have no confidence in your ability. If you are certain you can do it, choose 100% since you have 100% confidence in your ability.

#### ***Rating Scale***

1 = 0% (Completely certain I cannot do it at all)

2 = 10%

3 = 20%

4 = 30%

5 = 40%

6 = 50% (Moderately certain I can do it)

7 = 60%

8 = 70%

9 = 80%

10 = 90%

11 = 100% (Completely certain I can do it)

#### **VLSE Scale Items**

1. Enhance the clarity of my virtual team's communication.
2. Choose the correct communication method depending on message content.
3. Improve my virtual team member's trust in me.

4. Help virtual team members understand everyone's role.
5. Empower each virtual team member to take action when they see an opportunity to utilize their skills.
6. Identify virtual team processes that need more structure.
7. Customize my leadership style to the characteristics of my virtual team.

### **VLSE Parallel Form Items**

1. Improve my virtual team member's trust in me.
2. Develop methods that make clear virtual team communication easier.
3. Know the advantages and disadvantages of each communication medium.
4. Make my virtual team members' roles clear.
5. Give my virtual team members control over their tasks.
6. Ensure virtual team members are incentivized in their role.
7. Recognize the interdependence of my virtual team's tasks.

### **VLSE Trust Scale Items**

1. Repair trust in my virtual team.
2. Identify mistrust among virtual team members.
3. Recognize when virtual team members do not trust me.
4. Mend relationships with virtual team members who do not trust me.
5. Mitigate unpredictability in the virtual team.
6. Let virtual team members monitor their own performance.

### **Conditions of Use For The VLSE Scales**

*These scales are copyrighted and are only permitted to be used for non-commercial research purposes only. These purposes include furthering research that is purely academic or public-good driven. Commercial use of the content (direct or indirect use for profit-seeking or other financial or commercial motivations) is strictly prohibited without the written permission of the rightful owner. To request commercial access, please contact [kelseylen@ksu.edu](mailto:kelseylen@ksu.edu).*