Summer 8-2023

A Help or Hindrance? Team Leader Behaviors and the Team Climate of Innovation

Matthew Brady Johnson

A HELP OR HINDRANCE? TEAM LEADER BEHAVIORS AND THE TEAM CLIMATE OF INNOVATION

by

Matthew Brady Johnson, B.S., M.A.

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

COLLEGE OF EDUCATION AND HUMAN SCIENCES
LOUISIANA TECH UNIVERSITY

August 2023

LOUISIANA TECH UNIVERSITY

GRADUATE SCHOOL

June 26, 2023

Date of dissertation defense

We hereby recommend that the dissertation prepared by

Matthew Brady Johnson, B.S., M.A.

entitled **A Help or Hindrance? Team Leader Behaviors and the Team Climate of Innovation**

be accepted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Industrial/Organizational Psychology

Marita Apter-Desselles
Supervisor of Dissertation Research

./Steven Toaddy
Head of Psychology and Behavioral Science

Doctoral Committee Members:
Tilman L. Sheets
Frank Igou
Michael J. Apter

Approved:

Don Schillinger
Dean of Education

Approved:

Ramu Ramachandran
Dean of the Graduate School

GS Form 13a
(01/20)

ABSTRACT

While the nature of teamwork in organizations is ever-evolving, the utilization of teams in some form has continued to increase over the past several decades. While creativity is generally regarded as an individual-level phenomenon, innovation tends to occur as an emergent process at the team level, so rather than only hiring and rewarding star performers, organizations should cultivate and protect the team's climate for innovation. A particularly impactful contextual factor in team climate is the team leader's behavior. Therefore, the team leader's contribution to the climate should work to promote innovation rather than discourage it. A cross-sectional, correlational study surveyed participants who identified as part of a work-related team. They were asked about the motivational states their team leaders encourage (the *motivational micro-climate created by the leader)* and about their team's climates of innovation and psychological safety. A regression-based analysis found the relationship between a psychologically diverse micro-climate encouraged by the team leader and the team's climate of innovation to be significant ($B = 0.11$, 95.00% CI [0.10, 0.13], $p < .001$). The analysis also considered the potential mediating role of psychological safety, and a significant indirect effect was found ($\beta = 0.037$, 95.00% CI [0.012, 0.07]). Additional relationships between selected aspects of the motivational micro-climate (specifically, purpose and change orientation) and selected factors of innovation (specifically, team orientation and vision) were examined with a moderated mediation model through conditional process analysis. Notable findings here were a positive relationship between the leader micro-climate of.

change orientation and the team climate of innovation (*B* = 0.09, 95.00% CI [0.05, 0.13], $p < .001$), that was partially mediated by the team climate of innovation factor, task orientation (*B* = 0.10, 95.00% CI [0.06, 0.13], $p < .001$).

APPROVAL FOR SCHOLARLY DISSEMINATION

The author grants to the Prescott Memorial Library of Louisiana Tech University the right to reproduce, by appropriate methods, upon request, any or all portions of this Dissertation. It was understood that "proper request" consists of the agreement, on the part of the requesting party, that said reproduction is for his personal use and that subsequent reproduction will not occur without written approval of the author of this Dissertation. Further, any portions of the Dissertation used in books, papers, and other works must be appropriately referenced to this Dissertation.

Finally, the author of this Dissertation reserves the right to publish freely, in the literature, at any time, any or all portions of this Dissertation.

Author Matthew B. Jalen

Date 7/17/2023

GS Form 14
(5/03)

DEDICATION

Jess, without you, I would not be me. You provide me with kindness and strength that I do not offer to myself. Your support for and patience with me far supersede this dissertation or doctorate, but this has been a fantastic exemplification of what an incredible partner you are in life. Everyone mentioned in the Acknowledgment (and more), played a part and deserves recognition, but this dissertation is dedicated to you. You pushed me to finish, and here it is, and it's for you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

I would like to express my deepest gratitude and appreciation to all those who have supported and guided me throughout the journey of completing my doctoral work. First, those who make up the Louisiana Tech I-O Psychology core faculty and my dissertation committee, Michael Apter, Mitzi Desselles, Frank Igou, Tilman Sheets, and ./Steven Toaddy, you have each played a very different and specific role in my growth and success during this time – and I am appreciative of the genuine friendships we have formed.

Camille and David Roark, you believed in me early on and funded my earliest grad school efforts. My friends, who have kept me sane, and my family supported while I have been burning the candle at both ends, are next to be thanked. There are too many to include in the exhaustive list, which perfectly exemplifies the good fortune we've experienced this season. Still, the Kesslers, Pendergrasses, and Stones must be acknowledged for playing an integral part. Shane McKnight, you were a crucial partner, editor, collaborator, and motivator. My parents, John and Regina, and my children, Arayla and Malachi, all believe in me way too much; but your notion of me helped push me to actually accomplish what you knew I could.

CHAPTER 1

INTRODUCTION

Organizations, especially sizable ones, have largely moved away from a traditional structure and toward a network model of interdependent teams (Indranil et al., 2019). Although most organizations have already shifted away from traditional structures and toward a teams-based model, there is no standard path, process, or model to follow (Schwartz et al., 2019). For example, many companies espousing methodologies such as *Agile* (Rigby et al., 2016), do not follow a common method for team organization, management, communication, or evaluation (McKinsey, 2023). Even though best practices have yet to be established, there is a continuous, inter-industry shift toward team-based, or network-based, organizations. The move to teams has been a slow, several decades long shift that reached a tipping point in the mid-2000s, and the teams literature has followed with exponential growth in the past 10-15 years (Mathieu et al., 2017). The research and applied practice of team dynamics now has many researchers, business leaders, and strategists asking age-old questions, such as individual or group-based compensation models, in a new context, as well as some altogether new questions. Should performance management, communication structures, compensation, and other basic functions of human resources and business management move to a collective model or remain individualized? How different is the role of team leader than that of the traditional manager? Should the leadership literature be merged with the teams' literature to match the new paradigm taking place in modern organizations; are topics such as emergent leadership, shared leadership, and team external leaders more important and applicable than senior-level, top-management leadership (Mathieu et al., 2017; Mumford et al., 2002)?

Review of Literature

Contributing factors to the momentum toward team-based organizations are the adaptability, speed, and a competitive advantage in creating solutions to new or unforeseen demands (Miller et al., 2016). The necessity of flexible organizations are not only limited to business or market demands, but are intertwined with society and technology in an age of continuous transformation (Van Veldhoven & Vanthienen, 2022). The business case for this move to teams is intuitively attractive, but there are many aspects of team processes that have yet to be tested and evaluated (Mathieu et al., 2019b). To be adaptable, a team must meet its baseline requirement and function well at fundamental tasks as creativity and innovation are rarely outcomes of poorly functioning or unhealthy teams (Anderson, et al., 2014). In addition to what researchers have uncovered healthy teams, the antecedents and obstructors of creativity and innovation must be understood at the team level, or teams may be mistakenly structured or facilitated in a way that fosters groupthink or social loafing. Teams research has consistently investigated and demonstrated ways that teamwork generates productive work (Mathieu et al., 2019a), and that appropriate leadership behaviors can further increase productivity (Hackman & Wageman, 2005). The antecedents, mediators, and moderators of productivity in teams have been studied extensively, but now researchers are investigating if productive team-based work has the same relationship with innovative team work. Some say it does (Anderson et al., 2014; Hughes et al., 2018; Hülsheger et al., 2009; Kozlowski & Ilgen, 2006), and others are not so sure. The debate is ongoing, but some constructs, such as trust, affect both productivity and innovation (Mathieu et al., 2019a).

There are many antecedents to team-based outcomes, and the role of the supervisor, management, or organizational leadership are some of those principally studied. Many suggest that leaders do have real, measurable impact (Frazier et al., 2017; George & Zhou, 2007; Hackman & Wageman, 2005), other disagree (Eisenbeiss et al., 2008), and some are left without strong support either way (Kozlowski et al., 2009; Siegall & Gardner, 2000). If leaders do indeed affect team outcomes, how can managers and consulting practitioners be sure that team leaders help, or at least not impede, performance or innovation? Many studies, even team studies, look at the impact of the leader on the individual, e.g., how positive leader relations leads to psychological safety (Frazier et al., 2017), which in turn influences creativity, but more research is needed to understand how leaders affect innovative outcomes at the team level (Stollberger et al., 2019). One way to approach this would be through team climate.

An organization's overall climate, "the shared meaning organizational members attach to the events, policies, practices, and procedures they experience and the behaviors they see being rewarded, supported, and expected" (Ehrhart & Schneider, 2016; Ehrhart, et al., 2014), may accommodate innovative activities or even foster innovation (Amabile, 1996). A team's climate can influence outcomes such as productivity (Chen et al., 2007) or communication safety (Wang et al., 2014), but a team's climate may not be a powerful enough force on its own to produce a phenomenon as specific and scarce as creativity or innovation. Especially when the available research demonstrates the presence of different moods or psychological states, fluid and dynamic experiential episodes, that may be the key to understanding complex phenomena (Anderson et al., 2014; Apter & Carter, 2001; Csikszentmihalyi & LeFevre, 1989; George & Zhou, 2007; Kiverstein et al., 2020; Schoemann et al., 2017). Could this combination or diverse set of psychological states in the team member be influenced by the team's climate? To what degree is the team's climate influenced by the team leader? Should the leader promote a balanced climate in which all psychological states, moods, or emotions can thrive, or skew the team toward the most optimal states for innovation? What would moderate the team leaders' ability to impact a team climate that facilitates creativity or innovation? Organizations drive forward with their ever-expanding teams-based structure, fairly certain that this will lead to innovative outcomes, but researchers should continue to test these assumptions to better understand the moderating effects of contextual elements; in this case, we look at the team leader.

Teams

At the center of this study on climate, leadership, and innovation is the context of these constructs, the team setting. Many organizations and industries have converted to flatter, team-based organizations, thus teams have now become the context for and vehicle through which they produce goods, information, and services. Researchers are catching up to this reality through a surge of research on teams (Mathieu et al., 2017), but much of psychology is, by design, focused on the individual, but organizational psychologists must approach teams through a multilevel lens (Bliese et al., 2019; Chan, 2019; Klein & Kozlowski, 2000; Molleman, 2005).

Since the thorough study of teams spans individual, dyad, group, and organizational level, constructs are either organizational, team-level, or individual-level. Shared, team-level constructs may originate in the individual but are understood to be shared with the team, such as interpersonal trust or team potency (Molleman, 2005). The team-level offers something that individual-level constructs do not, emergent states, which are a gestalt phenomenon that occur through team processes (Klein & Kozlowski, 2000). Individual-level constructs and team constructs interact with one another to add a level of nuance and complexity to team studies (Chen et al., 2007), e.g., team potency and individual adaptability both impact the other, and each influence team performance (Monteiro & Vieira, 2016).

The study of emergent states and processes has increasingly dominated the study of team over the last two decades, which has contributed new insights to the literature (Chan, 2019). In their review, Rapp et al., (2021) show that many states that have been examined under the cognitive, affective, and motivational categories fall into categorical amalgams of the three taxonomic distinctions. Though this present study does not aim to contribute to the ongoing investigation into parsing constructs and furthering multilevel taxonomies and definitions, it does investigate constructs emerging at the team level. Also germane to this study, creativity is an emergent characteristic in the individual while innovation is more supported as an emergent process in the team (Hughes et al., 2018). Emergent team states are, “constructs that characterize properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes. [They] describe cognitive, motivational, and affective states of teams, as opposed to the nature of their member interaction." (Marks et al., 2001). Emergent states may mediate or moderate the appearance and continuation of innovation.

Motivation and Phenomenology

Frameworks regarding motivation typically fall into two distinct categories: content theories and process theories. Content theories such as Maslow's hierarchy of needs (1943) to Deci and Ryan's self-determination theory (SDT) (1985) categorize and describe basic human needs for psychological health or wholeness, where process theories such as Vroom's (1964) expectancy theory or Locke and Latham's (1990) goal-setting theory describe how behaviors are initiated or perpetuated. Content and process theories are not completely interdependent, but the distinction can be helpful when researching and applying the various theories. Whether content or process, working within the framework of a single theory provides guiding principles, measures, and objectives, and can result in measurable positive outcomes (Deci et al., 2017; Latham & Locke, 2018). An essential characteristic of motivation that is missing or glossed over from many theories is the experience of the individual. Content theories attempt to define *what* motivates people and process theories attempt to describe *how* they are motivated, but to fully explore motivation one must attempt to understand the phenomenological aspect of motivation, or the *when, where,* and *why* in moments when motivation grows, diminishes, or switches.

Perhaps the most well-studied phenomenological phenomena is the experience of flow. An optimal state of intrinsic motivation, flow is characterized by full immersion, energy, focused involvement, an altered sense of time, and enjoyment in a task

(Csikszentmihalyi & LeFevre, 1989). The phenomenon has been studied due to observed outcomes such as productivity, creativity, and the willingness to continue a laborious task. Flow can even be a shared phenomenon among teammates (Walker, 2010). Researchers of flow understand the state is not the typical or only state workers experience (Shepherd, 2021), but there has not been a well-tested, and certainly not a largely adopted, model for the other states that a worker may experience throughout a period of involvement with a task. Despite the considerable breadth of scholarly research and public awareness of flow due many popular books, many managers are likely still ill-informed and ill-equipped to make the theory actionable and facilitate or support the flow state in their employees (Jackson, 2012).

Flow is a state, which is conceptually different from a trait, due to its shorter duration, reactive nature, and higher sensitivity to situational stimuli (Fridhandler, 1986). Many fields within psychology acknowledge the importance of state difference, from sport performance to treatment for depression (Boag, 2018; Desselles & Apter, 2013; Kiverstein et al., 2020). Phenomenological workflow and creativity studies have been primarily preoccupied with Csikszentmihalyi and LeFevre's (1989) state of optimal flow. There is ample reason to hypothesize that there may be many other moods, emotions, or states to explore that would facilitate creativity or innovation (Binnewies & Wörnlein, 2011; Edwards & Lambert, 2007; Fong, 2006; George & Zhou, 2001, 2002, 2007). Others have exposed inconsistencies in the assumptions of outcomes of positive and negative affect, and have shown that variable outcomes in creativity research may be based on the dynamic, changing states of the individuals observes (Amabile et al., 2005). Hence, this study approached creativity and innovation through a phenomenological lens.

How does the behavior of the team leader affect the experience of the team member in a way that creates a team climate? Is the dynamic that creates this climate key to understanding the spark that ignites creative ideas and innovative work in the team?

Reversal Theory

Reversal theory is a structural, phenomenological theory of motivation that attempts to provide an account for the perceptions, feelings, and actions of an individual (Apter, 2007). This theoretical “structure of experience” is composed of four pairs of metamotivational states, or domains, that do not adhere to the principle of homeostasis found at the basis of many psychological theories regarding affect, arousal, and experience (Apter, 2001). Contrary to the homeostatic assumption, reversal theory draws from the fields of biology and cybernetics to postulate a closed system based on causality and feedback. This synergistic system produces bistable pairs of states that may reverse due to stimuli, satiation, or a cause not discernable (Smith & Apter, 1975). Understanding mental states as multi-stable, rather than a psychological state continuum with a preference for homeostasis, provides an alternative perspective on situations. States in bistable pairs allow for the individual to ease distress, create solutions, and utilize alternative modes of processing or coping.

The four domains of reversal theory each have two corresponding states of a complementary and opposite nature. There is no spectrum in each pair domain or partial states, though some states may be more salient in one’s awareness (Apter, 2001). One may imagine the eight states in four pairs as a light switch panel with four toggles; each switch must be fully engaged in one direction or the other (Apter, 2005). The states are each experienced as they relate to different experiential domains. The means-ends domain comprises the telic (serious or long-term) and paratelic (playful or in the moment) states; the means-ends domain relates to whether one is arousal avoiding (telic) or arousal seeking (paratelic). The rules domain contains the conformist (or "conforming") or negativistic (or "rebellious") states; these relate to whether or not one is seeking to fit in (conformist) or freedom (negativistic). The interaction (or "transactions") domain consists of the mastery and sympathy state; these states relate power/control or caring/support. Lastly, the autic (or "self") and alloic (or "other") states form the orientation (or "relationships") domain, which indicates whether someone is motivated by individualist or collectivist notions (Apter, 2001, 2005). The synonyms in parentheses are the most commonly used among researchers and practitioners to this date, but much of the literature cited still utilizes terms such as "telic" rather than "serious."

Contrary to traditional models of aggregated and averaged behavior over time, or trait models, reversal theory is especially cognizant of situational and internal shifts. While trait research, i.e. five-factor model (Ehrhart et al., 2014; McCrae & Costa, 1987), Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1943), or 16 personality factors (Cattell, 1957), is able to predict broad categories like performance. Trait theory is too simplistic and static to explicate an emergent state like creativity. Some researchers have found traits as predictors of creativity, but innovation is much more determined by dynamic and emergent phenomena like climate, team processes, and the team leader (Hammond et al., 2011). Traits may aid in situations in which simplistic predictability is sufficient, but the highly researched five-factor model (FFM) of personality cannot explicate dynamic or emergent phenomena innovation unless it continues to develop into something more dynamic (Boag, 2018; DeYoung, 2015). Some reversal theory researchers are guilty of treating state dominances as traits, thus violating the general scientific principle of parsimony, but there is a distinct difference between similar behaviors and similar motivations (Svebak & Murgatroyd, 1985). One may demonstrate the same behavior on multiple occasions for different reasons, such as studying for a test on one occasion to accomplish an overall goal of gaining a degree and at other times to impress the professor; traits, or other individual differences such as cognitive ability, does not give the researcher explanatory tools in many situations.

Reversal theory is ripe for use with teams in organizational contexts as it has been researched and applied liberally in both team sports and management within organizations (Apter, 2001), and its relationship to flow has been acknowledged (Wright, 2016). Other frameworks and bodies of literature are similar to reversal theory in how they recognize variable outcomes to psychological states (Amabile et al., 2005; Anderson et al., 2014; Binnewies & Wörnlein, 2011; Fong, 2006; George & Zhou, 2001, 2002, 2007), moods (George & Zhou, 2007; Huang et al., 2012), and even how to "tune" moods (Kiverstein et al., 2020).

A core proposition of reversal theory is that a person will shift between states throughout the day in order to respond to changing situations and address diverse demands, and access to all states is characteristic of a healthily functioning psyche (Apter, 2007). The term used for this equal access is psychodiversity. Named deliberated to draw a connection to biodiversity; it illustrates the notion that ongoing survival, or even flourishing, is dependent upon adapting to one's environment (Apter, 2001). Psychodiversity has been discussed in reversal theory literature as an indicator of a healthy individual's ability to switch between states when needed to access more wellrounded and adaptive perspectives and behaviors (Apter, 2001). Not getting "stuck" in a motivational state or having extreme state dominances, demonstrating psychodiversity, can lead to increased resilience and wellbeing (Alfonso & McDermott, 2020). The essential nature for psychodiversity in organizations will be covered more fully in the following section on leadership.

A non-phenomenological, broader content theory such as self-determination theory is helpful to understand the needs and motivations of workers, but the basic tenets are broad and are found wanting when explicating situational changes (Deci et al., 2017). The theory may inform job redesign or organizational development initiatives, but managers or team leaders may struggle to gain insight into the day-to-day activities and actions of their direct reports. Reversal theory postulates that psychological states will change throughout a given work period, thus the driving motivations for workers will change as well. A team leader will likely not have the time to accommodate every state's preference for every worker in any given moment, so an opposite problem arises, from not enough specificity with SDT to too much variability with reversal theory.

Leadership

In organizations with a multilevel team-based structure, motivation, and more specifically creativity, occurs in the individual worker as well as an emergent state in the team (Amabile & Pratt, 2016; Hammond et al., 2011). It may be surmised and safely assumed from the literature that this complex phenomenon involves many antecedents, moderators, and mediators between the employee and the outcome (Mathieu et al., 2019a; Rapp et al., 2021), but this study focused on and explored leadership as a proximal predictor variable. This study's focus on supervision is due to the capability of an organization to intervene on a team's innovative capacity through the leader, relative to other proximal contextual factors. Leaders, managers, supervisors, or simply, *team leads,* can be trained, fired, and selected.

Leadership has been studied for over a century and in that time has evolved from describing inborn traits of a culturally-derived archetype with no basis of effectiveness to an effort of empirically observing the outcomes of leader behavior. (Lord et al., 2017). Even so, the definition of leadership and the application of various theories are often vague and lack contextual sensitivity, and many lack specificity for which level in the organization the leadership methods are most applicable. Northouse (2018) defines leadership as, "a process whereby an individual influences a group of individuals to achieve a common goal." This simple delineation, while vague, is precisely the definition used in this study. Strategic, political, top-of-organization leadership, or "external leadership" (Mathieu et al., 2019a) is a distal, contextual organization-level influence on this study's outcome of interest, so the scope will be limited to constructs and phenomena related to small group or team-level leadership. Use of the term *leadership* can be unhelp since it applied so broadly, e.g., hierarchical leadership and the theories associated with it, such as charismatic leadership (Fuller et al., 1996) and the intimate, dyadic understanding of leadership, such as leader-member exchange (LMX) (Martin et al., 2018), are both uses of the term. The heterarchical understanding of shared or distributed leadership is more germane to a teams-based context, but the additional influence of a team's leader remains distinct from that of a coworker or teammate; a leader can influence the group and pairwise interactions of the team through changes to the team's climate.

There are many variables in the process of leadership that are uninvestigated, debated, or to-date unknown, but there is support for shared leadership and empowerment from the leader increasing intra-group trust, cooperation, performance, and satisfaction (Bergman et al., 2012; Chen et al., 2007; Drescher & Garbers, 2016; Hill & Bartol, 2015; Siegall & Gardner, 2000). Leaders also seem to have a direct impact on the psychological safety of team members and the climate of safety of the team (Frazier et al., 2017). Transformational leadership, although too broad and undefined to understand exactly why, has been linked to innovative behaviors of a team (Eisenbeiss et al., 2008; Xenikou & Simosi, 2006). Leaders and their behaviors, agnostic of theory, has also been shown to be an antecedent or moderator of creativity (George & Zhou, 2007; Hughes, et al., 2018), performance (Hackman & Wageman, 2005), innovation (Hughes, et al., 2018; Kozlowski & Ilgen, 2006; Scott & Bruce, 1994), and adaptiveness (Kozlowski et al., 2009; Ployhart & Bliese, 2006). While the support for leader influence is abundant, a clear limitation of these findings are the confounding variables and other criterion issues associated with conflating behaviors and non-behavioral concepts (Banks et al., 2021).

Teams have primarily been studied with productivity in mind. Now that more supervisory, executive-level work is taking place in teams *and* the economic value for organizations is shifting from goods or services to usable knowledge (data, insights, and strategies), teams must be studied for what variables are antecedents, moderators, and mediators for creativity and innovation. Mumford et al. (2002) described a leader's role in fostering creativity as: "the exercise of influence to increase the likelihood of idea generation by followers and the subsequent development of these ideas into useful products". In many organizations, leaders have the power to reward or punish, thus wielding strong influence over the extrinsic motivation of their direct reports, but can an external force such as leadership have a deep enough impact to affect the intrinsic motivation involved in creativity or innovation? Researchers have noted the impact that leaders' seem to have on intrinsic motivation, as demonstrated by increased performance and satisfaction, and lowered turnover (Deci et al., 2017); but, the question remains whether leaders behaviors are a driving force behind creativity and innovation, or whether the best leaders are simply setting the table for the creative or innovative process, like servant leadership unto creativity.

Team leaders, and their various methods, may influence different outcomes over the lifespan of the team, such as a directive leaders' stronger impact on performance early in the life cycle of a team and empowering leaders' stronger impact on performance in longer-running teams (Lorinkova et al., 2013). Empowering leadership contributes to a more productive and collaborative team in both in-person and virtual settings (Drescher & Garbers, 2016; Hill & Bartol, 2015), and shared leadership leads to more cohesion (Bergman et al., 2012). Team leaders have been conceptualized as directors of "facilitating factors" that foster creativity, including work environment, stimulants, and inhibitors (Eunice & Alencar, 2012; Paletz, 2012; Stollberger et al., 2019). Therefore, the impact of the leader upon a team's climate is of special interest. Specifically, how a team leader alters a team climate that in turn frustrates, facilitates, or satiates the psychological states of team members should be understood. Climate in team settings is an indicator of all outcomes (Mathieu et al., 2019a), climate in team settings has a strong influence on innovative outcomes (Hughes et al., 2018), and the supervisor is a top contributor to a team climate of innovation (Hunter et al., 2007). Reversal theory researchers and practitioners have, for at least two decades, hypothesized the leader's impact on the team "micro-climate", but more study is needed (Apter & Carter, 2001, 2002; Carter & Kourdi, 2003).

Apter Leadership Profile System

An approach to leadership, the Apter Leadership Profile System (ALPS), has been used in private organizations for decades, but more research is needed to fully understand the implications of reversal theory-based management methods (Carter & Kourdi, 2003). The ALPS is rooted in the cross-disciplinary body of reversal theory literature, see Table 1 for the corresponding state and climate terms. The more awareness and control an individual has of their motivational states, the more motivational intelligence they are understood to have (Apter, 2007). Motivational intelligence is an essential skill for any leader (Apter & Carter, 2001). The mark of a good leader is one who can identify and create the right motivational micro-climate for their direct reports and team members.

Table 1

Reversal Theory Metamotivational States with Correlating Micro-climates

	Pair 1	Pair 2	Pair 3*	Pair 4*
Leader Micro-climate	Purpose	Structure	Individual Contribution	Consideration
DR motivated by	Significance	Fitting In	Personal Power	Being Cared For
State(s)	Telic	Conforming	Self-Mastery	Self-Sympathy
	↕	↕	↕	↕
State(s)	Paratelic	Negativistic	Other-Mastery	Other-Mastery
DR motivated by	Enjoyment	Freedom	Empowering Others	Caring for Others
Leader Micro-climate	Energy	Change Orientation	Enablement	Warmth

Note. DR = direct report (i.e., follower, subordinate, or team member)

The psychological climate comprises the sum of interactions with the employee's organization, co-workers, and leaders (Wang et al., 2014). While the importance placed on leaders, in both research and practice, can sometimes be overinflated, they are a strong variable in the equation that calculates psychological climate. They are an essential environmental consideration when determining if an organization has a healthy or high performance motivational atmosphere (Kontoghiorghes, 2016). In the ALPS, the "micro-climate" reflects the motivational climate created by a specific leader; a leader's micro-climate contributes to the organization's climate, and expressly, the atmosphere of their direct reports (Apter & Carter, 2001; Robson & Carter, 2007). Just as a psychologically healthy individual is versatile in their motivations, a leader should furnish a balanced micro-climate for their direct reports (Apter & Carter, 2002). A micro-climate that primarily concentrates on one or a few aspects of human motivation can be limiting or even debilitating to employees in a work environment. The ALPS measure was developed to evaluate both the leader's natural tendencies and time spent in different micro-climates and the motivational needs of their direct reports, peers, or both (Apter & Carter, 2001; Robson & Carter, 2007). A leader cannot control what motivates their followers, but they may have the ability to encourage others toward the appropriate motivational state for the given situation (Apter, 2007). The ALP system provides a framework for a leader and team members to participate in a psychologically diverse environment that allows space for multiple motivating factors, which can provide an alternative schema, a loose method, for team leadership to spur creativity or innovation in the team. Next, we parse the difference between the related but distinct constructs of creativity and innovation.

Innovation and More About Climate

The experience of the team members, the behaviors of the leader, and the subsequent climate of the team are all important because they affect the team's outcomes. Many outcomes, especially productivity, have been heavily studied for the past two decades. Many sectors of the American economy are still service-based, but there is an ever-increasing shift toward being an information-based economy. This is evident by business deals such as tech companies paying far over the standard (sales-based) valuation for acquisitions of companies in which data is rich (Frier, 2014). Shifts in what drives the economy should cause a re-evaluation of what should be considered a primary outcome or goal of an organization, and thus the work teams they comprise. The value of creative insights, or innovation, may now be what efficiency or high production once was when manufacturing was at the center of the economy. Organizations that set up their teams for innovation may have the competitive edge that leads to key to success and long-term survival.

Creativity and Innovation Defined

Creativity and innovation are intimately related but distinct. Creativity is characterized by the cognition and behaviors that lead to the generation of new ideas, and innovation is a process of making novel or disparate ideas actionable; innovation is the implementation of creativity (Hughes et al., 2018). This distinction is supported by differing findings about how the two react differently to moderators, such as how psychological safety more strongly moderates innovation and psychological contract moderates creativity, but there is common variance in the moderating constructs. Though counter arguments are abundant, a helpful way of understanding this in a multi-level, team context is: individuals are creative and teams are innovative (Hughes et al., 2018). Another way to look at it is a two-step process where step 1 is the generation of new ideas, creativity from an individual, and the implementation of those ideas, innovation that typically requires the involvement of others (Stollberger et al., 2019).

The literature of the phenomenon of Innovation in teams is in its early stages of assembly, and Hughes et al. (2018) propose that the mediators between leaders and innovation could be motivational, cognitive, affective, identification-based, and social-relational. They also propose the moderators of a positive relationship between leaders and innovation to be the team/organizational context, follower attributes, relationship attributes, and leader attributes, and the moderators of a negative correlation to be follower attitudes, relationship attributes, and follower attributes. Anderson et al. (2014) found that many of these have state-based rather than trait based factors when they surveyed the literature regarding creativity and innovation in organizations. Specifically, George and Zhou's (2007) work on "dual tuning" of both positive and negative moods to achieve innovative results, which raises more questions than answers, but still demonstrates a dynamic, and at times paradoxical, framework may be needed to understand or operationalize innovation.

Team Climate and the Team Leader

A leaders' effect on innovation has primarily been studied through the theoretical lenses of transformational leadership and LMX. Issues arise with transformational leadership theory due to its breadth, as it has divergent factors (Li et al., 2015), and LMX cannot provide explanatory assistance because it is a measured outcome of a leadership process rather than the explication of a process. Transformational leadership theory, even if more useful as a process, still suffers from its preoccupation on the individual differences and qualities of the leader. Other than its fourth factor, individualized consideration, it is a static portrait of a leader rather than a dynamic set of principles that a leader can employ to equip and support the emotional and motivational needs of their followers. Also, it has not been supported in the way that one may assume after 40+ years of heavy attention from many fields of research (Siangchokyoo et al., 2020). Leadership studies regarding the day-to-day, team setting should focus on how the leader contributes as a contextual factor or antecedent to emergent processes and states in the team. As a leader pulls the levers of influence at their discretion, they are able to affect the extrinsic motivating factors for their direct reports and team members. Extrinsic motivation can hamper creativity, but in some cases can assist the innovative process (Csikszentmihalyi, 2014).

Amabile (1993) published a model of creativity and innovation, but revised it many years later to make it more accurately reflect the literature (Amabile & Pratt, 2016). There are many additions in the updated model, but the majority of them include references to a synergistic relationship between intrinsic and extrinsic motivation and the part the team leader plays in supporting the various forms of motivation. Though various types of creativity are known to predict creativity, their addition of work orientations, affect, and applying meaning to work is new and focused specifically on group innovation (Table 2).

Table 2

Motivations to Innovate, and Skills in Innovation Management (Amabile & Pratt, 2016) with Corresponding ALPS Micro-Climates (Carter & Kourdi, 2003)

Micro-Climate Fostered	Motivations to Innovate, and Skills in Innovation Management
Purpose (telic)	Clear project goals Learning from problems
Energy (paratelic)	Open idea flow
Structure (conforming)	Mechanisms for developing new ideas
Change Orientation (rebelling)	Value placed on innovation Support for reasoned risk-taking & exploration
Individual Contribution (self-mastery)	Autonomy in how to meet project goals Work assignment matched to skills & interests
Enablement (other-mastery)	Participative decision-making Frequent, constructive feedback on new ideas Collaboration & coordination between groups
Consideration (self-sympathy)	Equitable, generous reward & recognition for creative efforts
Warmth (other-sympathy)	Help with the work

The catalysts in Amabile and Pratt's new model (2016) include stimulants or catalysts that contribute to a climate of innovation. These catalysts are catalyzed by the teams' leader(s) and are in close alignment with the theory of team leader micro-climate found in reversal theory (Apter & Carter, 2001; Carter & Kourdi, 2003). The primary difference between the two is that the stimulants and catalysts are various resources provided by the team leader or behaviors they exhibit, and the ALPS provides higher order constructions of motivational states.

Amabile and Pratt (2016) state that the motivation for creativity is not a true addition to Amabile's original (1996) model, but rather a re-explanation of what undergirds the model. They draw from their own research, as well as others, to demonstrate the misconception that intrinsic motivation is the greatest cause for creativity and that novel ideas are solo phenomena. Distinguishing between extrinsic motivation and informational or enabling extrinsic motivation sheds light on what the role a team leader can provide (extrinsic) to the personal (intrinsic) motivations of the individual (Amabile, 1993). They draw from Grant and Berry (2011) to bring the team aspect to intrinsic motivation by demonstrating the interactive effects of intrinsic and pro-social motivation, which culminates in an other-focused perspective that can direct innovative energy to what would work best for the group and not the individual; a perspective captured in the ALPS model as two of the eight micro-climates (enablement and warmth) are others-focused.

Teams are temporal in nature, so leaders will propagate innovative work differently throughout the life-cycle. Morgeson et al. (2009) suggest that leaders may provide fundamental ingredients necessary to innovation in the transition phase by defining the mission, establishing goal, providing structure, sense making and providing feedback; thus, the leader is setting up an atmosphere of psychological safety and establishing norms for emergent mental models. Then, during the action phase, the leader can monitor the team, manage team boundaries, challenge the team, pitch in to help perform the team's tasks and solve problems, all while providing resources, encouragement, and supporting the social climate. These actions, or taxonomy of, team leadership establish and maintain the micro-climate of the team.

Morgeson et al. (2009) leadership functions were developed from surveying and analyzing the relevant literature, but is limited to research within organizations and is not derived from a broader psychological understanding. Although quite analogous, the ALPS micro-climate categories are both simpler and more holistic, see Table 3 for a direct comparison of the factors for the action phase of the team leadership questionnaire (TLQ). Notably, functions similar to *purpose* (reversal theory state: telic) and *energy* (reversal theory state: paratelic) are missing. This is important due to previous research on creativity from a reversal theory perspective pointing to creativity as a function of the paratelic-negativist state and innovation being linked with either the telic-negativist or paratelic-negativist state (Apter, 2001).

Table 3

Action Phase Leadership Functions (Morgeson et al., 2009) with Corresponding ALPS Micro-climates (Carter & Kourdi, 2003)

Micro-Climate Fostered	Action Leadership Function
Purpose	
Energy	
Structure	Manage Boundaries; Monitor
Change Orientation	Challenge
Individual Contribution	Encourage self-management; Solve problems
Enablement	Performing tasks
Consideration	Provide resources
Warmth	Support social climate

In a review of all team climate models for creativity or innovation, West and Sacramento (2012) acknowledge all taxonomies and models utilized and researched to that time. Though many, including some cited and referenced here, appear to be useful, one of the most cited and utilized is a theory of team innovation by West and Anderson (1996), that resulted in a measure (Anderson & West, 1998), that determined four factors to measure a team's climate toward innovation: vision, participative safety, task orientation, and support for innovation. This model, as compared with one like Amabile and Pratt (2016), does not conflate constructs and factors from the broader organizational or top management, and is not preoccupied with team composition or leader traits. The broader literature surveyed demonstrates that the proximal workgroup's, or team's, climate for innovation can be accounted for with Anderson & West's four factors with the greatest amount of parsimony.

Vision, as conceptualized by Anderson and West (1998), is when the clearly-defined and higher order goals drive the project's tasks, which is comparable to goal-setting theory from Locke and Latham (2002). Vision holds within it the facets of clarity, visionary nature, attainability, and sharedness. *Participative safety* is a complex construct that comprises interpersonal permission for involvement and a low sense of risk, so necessary prerequisites for participative safety on a team are trust in the leader, psychological safety, and interpersonal support. From a reversal theory perspective, psychological safety is a mechanism by which the protective frame can be formed; the protective frame is a mechanism that allows the serious task at hand to be approached through the paratelic state (Apter, 2007). Emotions associated with time pressure and high stakes, typically regarded as negative, can be experienced positively in the protective frame, which can mitigate the disruptive effects that stress can have on creativity or innovation (Hick & Derksen, 2017; Hughes et al., 2018). The *task* *orientation* factor is related to shared vision, but is evaluative and performative in nature. On a team, mutually shared accountability for continuous evaluation and improvement opens the door for constructive controversy. *Support for innovation* is "the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment" (West, 1990, p. 38). Lastly, *interaction frequency* is related to the need to understand the more proximal environment, unlike traditional climate instruments that are meant to measure climate of the entire organization (Payne, 1990). In order to truly demonstrate support, the team leader, and organization, must articulate and enact their endorsement for innovation, which means that resources and time must be allocated to the process. These five components of team-based innovation hold within them most of the research regarding the fostering innovation within organizations. They more closely align with the ALPS model of leadership than the traditional leadership functions gathered from the literature by Morgeson et al. (2009).

While these four factors for the development of a climate of innovation are helpful, placing them within the frame of reversal theory micro-climates brings both a systematic framework and an explanation for the flexibility, paradoxical emotions, and tension that is essential in leading change or innovative processes (Rothman & Melwani, 2017). This theory of emotional complexity is almost exactly what Apter and Carter (2002) spoke of fifteen years earlier when they referred to the motivational diversity of the leader (Table 4). Acknowledging the motivations and subsequent emotions of the leaders and followers is essential for exploring any moderative effects of a mismatch (van Knippenberg & van Kleef, 2016).

Table 4

Team Climate Factors for Innovation (Anderson & West, 1998) with Corresponding ALPS Micro-Climates (Carter & Kourdi, 2003)

Micro-Climate Fostered	Climate for Innovation
Purpose	Vision; Task orientation
Energy	Support for innovation
Structure	Task orientation
Change Orientation	Participative safety; Support for innovation; Task orientation
Individual Contribution	Support for innovation; Task orientation
Enablement	Support for innovation; Interaction frequency
Consideration	Participative safety
Warmth	Participative safety; Interaction frequency

Hypotheses

Teams are complex structures that produce emergent states and processes challenging to discern at the individual or organizational level, so researchers should always consider a multilevel perspective (Klein & Kozlowski, 2000). In this study, careful deliberation regarding how best to investigate variables correlating with a team climate of innovation. In this case, the research questions are best addressed by observing other group-level variables of interest. Past research demonstrates that team climate is a powerful predictor for many outcomes of the team, and team climate is particularly affected by the leader; whether considered a proximal, contextual input (Hughes et al., 2018), or a moderator between the inputs and emergent processes of the team (Stollberger et al., 2019). This study utilizes a phenomenological theory of motivation, reversal theory, to evaluate the perceived climate of team members since the subjective interpretation of experience (Kozlowski & Ilgen, 2006). A key tenant of reversal theory is that psychological diversity among all available psychological states is necessary and helpful (Apter, 2001). A strong predictor and moderator of team climate is the influence of the leader (Schaubroeck et al., 2011), especially regarding innovation (Hughes, et al., 2018; Kozlowski & Ilgen, 2006; Scott & Bruce, 1994). Traditional leadership theories, and the corresponding measurement instruments, will struggle to capture the influence of the leader on the team, therefore we will evaluate the leader by their motivational versatility and the micro-climate they stimulate (Alfonso & McDermott, 2020; Apter & Carter, 2001, 2002; Thomas et al., 2018), therefore:

H1a: *Team leaders who generate a more psychologically diverse micro-climate will have team members who report a higher team climate of innovation.*

There is widespread support for psychological safety and trust as necessary antecedents for creativity in individuals and teams within organizations (Edmondson & Lei, 2014; Frazier et al., 2017), so team antecedents such as a climate of participative safety and support for innovation bear theoretical weight as potential predictors of team innovation (Hülsheger et al., 2009; West & Sacramento, 2012). H1b tests the theoretical assumption that psychological safety should be higher when a balanced micro-climate of the leader provides an atmosphere in which team members feel that they can speak up, or be authentic, regardless of their motivating state.

H1b: *The effects of a psychologically diverse micro-climate will be partially mediated by a climate of psychological safety.*

Alternatively, since much of the research on individuals has shown rebellious (Apter, 2001) or radicalism (Csikszentmihalyi, 2014), and negative mood (George & Zhou, 2007) to strongly correlate with creativity. A competing Hypothesis to H1 is that:

H2: *Team members who report having leaders that exude a high change orientation micro-climate will also have team members who report a higher team climate of innovation.*

Figure 1 and Figure 2 show the relationships of the hypotheses.

Figure 1

Hypothesis 1

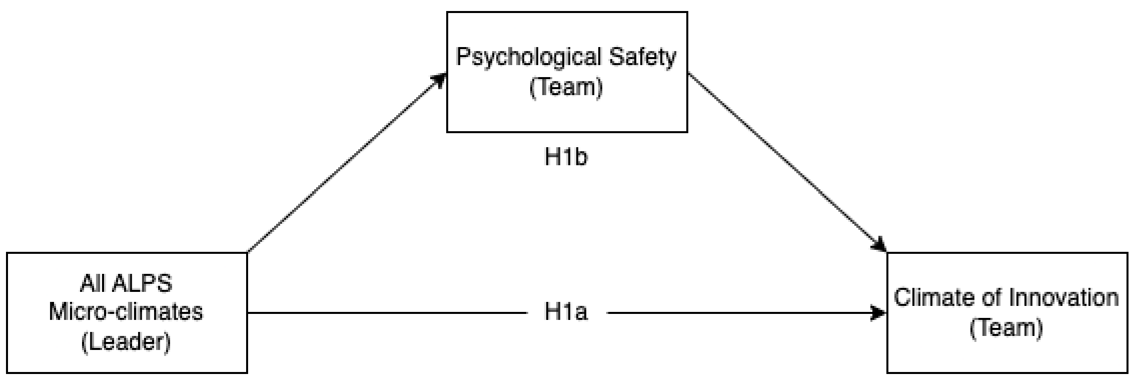
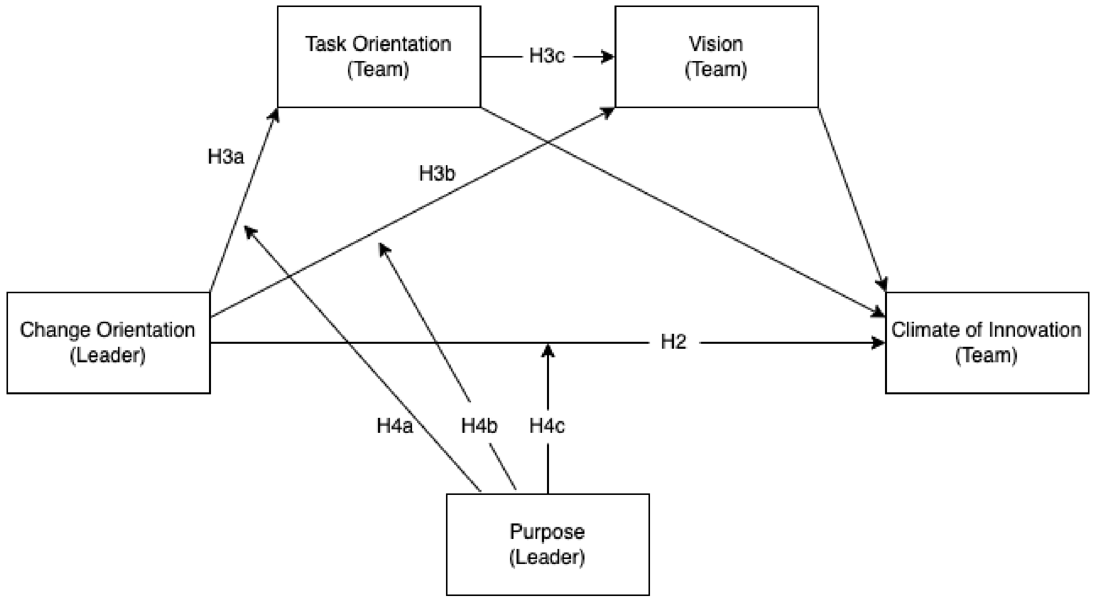


Figure 2

Hypotheses 2-4



Instead, leaders who encourage change orientation may only affect aspects of the team climate of innovation.

H3a: *Team members who report having leaders that exude a high degree of change orientation will also show positively related scores with the task orientation factor of team climate of innovation than those who report an average or below-average change orientation micro-climate.*

H3b: *Team members who report having leaders that exude a high degree of change orientation will also show positively related scores with the vision factor of team climate of innovation than those who report an average or below-average change orientation micro-climate.*

H3c: *Team members who report having leaders that exude a high degree of change orientation will also show positively related scores with the task* *orientation and vision factor of team climate of innovation than those who report an average or below-average change orientation micro-climate.*

Change orientation is based on the metamotivational state of rebelliousness, which is labeled dichotomously as proactive and reactive by McDermott (2001). Proactive rebellion is described as a state in which one opposes the rules or conformity for fun (a paratelic-rebellion) conversely, reactive rebellion is usually in response to a perceived injustice or unreasonableness (an autic-sympathetic-rebellion). Another combination of states, telic-rebellious, would describe someone who is both goal-oriented and avant-garde, e.g., the career activist, the strategic challenger, new tech pioneer, or the team leader who promotes goal-oriented creativity. A person like this could, as a leader, create a strong sense of purpose. This assumption is investigated by testing whether a strong purpose micro-climate will positively moderate the relationship between change orientation and the climate of innovation.

H4a: *Team members' scores of the leaders' micro-climate of purpose will positively correlate with the strength of the relationship between the change orientation micro-climate and the task orientation factor of the climate for innovation.*

H4b: *Team members' scores of the leaders' micro-climate of purpose will positively correlate with the strength of the relationship between the change orientation micro-climate and the vision factor of the climate for innovation.*

H4c: *Team members' scores of the leaders' micro-climate of purpose will positively correlate with the strength of the relationship between the change orientation micro-climate and the climate for innovation.*

CHAPTER 2

METHOD

Sample

The sample for this study was composed of 264 English-speaking adults aged 21 and over from the United States recruited through a participant recruiting online platform, Prolific. Only those with a survey participation quality rating, or "work approval rating", of 95% or above were included since participants in this category have been shown to respond better to attention checks and produce higher quality data (Peer et al., 2014). Participants were required to indicate that they currently worked in a team with a designated leader to be included in the sample. Other demographic information was collected to determine the representativeness of the sample, but age was the only socio-demographic basis for exclusion. The decision to set the minimum age of 21 was to increase the likelihood of past work experiences from which participants could derive a heuristic baseline for the constructs of interest.

Demographics

The demographic characteristics of the participants in this study were analyzed in terms of gender identity, race/ethnicity, and location in the United States of America. These demographic data include only those participants remaining after screening out invalid or inattentive responders. The screening process, and power analysis, will be described in full in the following sections.

Gender Identity

The gender identity distribution of the participants was as follows: 80 individuals (30.3%) identified as female, while 184 individuals (69.7%) identified as male. There were no participants who identified as transgender, nonbinary, or preferred not to answer.

Race/Ethnicity

Regarding race and ethnicity, the participants identified as follows: 204 individuals (77.3%) identified as White, 17 individuals (6.4%) identified as Black, 22 individuals (8.3%) identified as Hispanic, Latino, or of Spanish origin, four individuals (1.5%) identified as Hispanic, Latin, or of Spanish origin only, 17 individuals (6.4%) identified as Asian, one individual (0.4%) identified as Native American, and 20 individuals (7.6%) identified with more than one race/ethnicity. There were no participants who identified as Native Hawaiian or Pacific Islander, Middle Eastern or Northern African, or who preferred not to answer.

Location in the United States of America

The geographical distribution of the participants within the United States of America is as follows: 77 individuals (29.2%) were located in the Midwest, 50 individuals (18.9%) were located in the Northeast, 82 individuals (31.1%) were located in the South, 53 individuals (20.1%) were located in the West, and there were no participants located in U.S. territories.

Survey Service and Payment

Participants were recruited through the crowdsourcing platform, Prolific, which, compared to available alternatives (i.e., Amazon Mechanical Turk or CloudResearch), has demonstrated superior reliability and quality on metrics such as attention, comprehension, and honesty (Peer et al., 2021). Additionally, when compared to Amazon's MTurk, Prolific has also been shown to provide participants that were more naïve, which is a highly desirable sample parameter when attempting to bolster confidence in results and a plus when looking for true effects (Chandler et al., 2015), and were more demographically diverse (Peer et al., 2017). Participants were paid an average of $2.29 for the survey, which produces an average hourly rate of $14.31, which is 41.67% above the national minimum wage average of $10.08 per hour (U.S. Department of Labor, n.d.).

Materials

The three surveys utilized to measure the relationships between the hypothesized constructs were the Team Climate Inventory (Anderson & West, 1998), Apter Leadership Profile Staff (ALP-S) survey (Desselles & Crum, 2019; Robson & Carter, 2007), and seven items from the Psychological Safety and Team Learning survey (Edmondson, 1999; Valentine et al., 2015).

The Team Climate Inventory (Anderson & West, 1998) is composed of 38 items that have been shown to load onto four factors: vision, participative safety, task orientation, and support for innovation. Reliability for the factors fall within an acceptable range ($\alpha = 0.84\text{-}0.94$). Results of the four-factor solution produced good fit, χ^2/degrees of freedom = 1.96; Tucker Lewis Index (TLI) = 0.96; Normed Noncentrality Fit Index (CFI) = 0.96; Parsimonious Normed-Fit Index (PNFI) = 0.82. Within group (team) inter-rater agreement was within acceptable levels (0.67-0.98) (George, 1990; Nunnally, 1978). Between team differences were within acceptable levels ($F > 1$) in 24 of 25 teams used to validate the scale (Anderson & West, 1998).

Apter Leadership Profile (ALP) survey (Desselles & Crum, 2019; Robson & Carter, 2007) consists of two 40-item self-report surveys. The first is completed by leaders who report the motivational climate they have created, and the second is completed by their staff to report their perception of the motivational climate created by the leader. This study used the staff survey (ALP-S) to evaluate the micro-climate of the team leader from the team members' perspective. Desselles and Crum (2019) performed a confirmatory factor analysis that revealed revealed a good fit for the hypothesized 8-factor model both with leaders (χ^2= 1383.22, CFI = 0.891, GFI = 0.814, RMSEA = 0.055) and staff (χ^2= 2394.95, CFI = 0.939, GFI = 0.811, RMSEA = 0.054), using Byrne's (2010) fit index values.

Edmondson's (1999) scale for Psychological Safety and Team Learning (PS-7) was utilized in the evaluation of Hypothesis 1b. Seven items from the first of two factors, psychological safety, were administered for this study. The Cronbach's alpha for the psychological safety factor has been reported at 0.82 (Edmondson, 1999). Principal components analysis revealed loading onto the two hypothesized factors, with factor loadings greater than 0.4 and eigenvalues greater than 1.0.

Procedure

This cross-sectional, correlational study surveyed participants who identified as being part of a work-related team, but no part of the research questions necessitates they be members of the same team types (e.g., intact, project, or virtual). After the consent forms, participants answered questions regarding their views and experience of their leader and their perspective of the team to which they belong.

A Qualtrics link containing the survey was distributed to the respondents via Prolific after they were screened for age, work type, and participation rating, and agreed to the terms and conditions. An answer to each question was required before progressing in the survey, thus there was no need for mean imputation for missing data; thus, the only missing data were generated by those respondents who did not complete the survey, and these cases were completely removed from the data set (Beals & Nye, 2017). For each participant, two attention checks were used randomly throughout the survey, such as "please choose *Strongly agree*" and the respondents who did not comply with the item's instructions were removed from the analysis (Meade & Craig, 2012).

On the mathematical basis of ordinary least squares (OLS) regression and bootstrapped confidence intervals, a macro in version 28.0.1.1 of IBM's SPSS Statistics by Hayes (2022), PROCESS version 4.1, was used to analyze the data. The PROCESS package is a tool that combines many techniques for combining mediation and moderation within the same model, typically referred to as conditional process modeling, or more simply, *mediated moderation* or *moderated mediation* (Hayes, 2018). Given the complex nature of analysis of multiple mediating and moderating variables, consideration was given to structural equation modeling (SEM), but was not chosen due to its need for larger sample sizes to achieve stable parameter estimates (Wolf et al., 2013). SEM has many benefits, especially for studies that need to compare models with fit indices or have more than one outcome variable, but these concerns are not germane to this study (Hayes et al., 2017).

For Hypothesis 1a, the mean and standard error (SE) were calculated on the sample for each of the eight micro-climates, as reported by direct reports. Each leader was given a dichotomous score (1,0) for each micro-climate; a leader received a score of 1 for a micro-climate if they encouraged it at a rate of one SE below the mean or higher. Each leaders' dichotomous scores on the eight micro-climates were then summed, creating an aggregate score ranging from 0-8. The diversity of the motivational micro-climate encouraged by the leader was operationalized by the number of micro-climates the leader encourages at a rate higher than one SE below the average frequency in the sample. Thus, each leader's micro-climate diversity score of 0-8 was utilized for Hypothesis 1a and analyzed using ordinary least squares regression executed through the command for Model 4 in the PROCESS (Hayes, 2022) macro in SPSS.

Pre-set models in Hayes' (2022) PROCESS macro were also used for the remaining analyses. Model 4 (Hayes, 2022) was used for Hypothesis 1b, which investigated the degree to which the relationship between the leaders' micro-climate high availability scores and the team climate of innovation can be accounted for through the state of psychological safety. Hypotheses 2-4, modeled in Figure 2, were evaluated using Hayes' (2022) Model 85. Hypothesis 2-4 were investigated by comparing the significance, effect size, and confidence intervals in two versions of Model 85, one with all participants and one with only those scoring their team leaders one standard deviation above the mean for *change orientation*.

Power and Sample Size

While guidelines and best practices exist for common statistical procedures such as t-tests, linear regression, and ANOVA, the literature surrounding mediation models provides inconsistencies in estimating power. Monte Carlo simulations are used to estimate power for structural equation models (SEM) (Jobst et al., 2021; Wolf et al.,

2013) and simple and complex non-SEM mediation models (Preacher & Selig, 2012; Thoemmes et al., 2010). There are now many Monte Carlo-based power analysis tools, such as the shiny R application developed by Schoemann et al. (2017) and the SimDesign package by Chalmers and Adkins (2020). However, there are still no standard formulae, methods, or tools available or commonly used by researchers to calculate power a priori for non-SEM models containing both mediation and moderation like the one utilized in this study (Aberson et al., 2020; Giner-Sorolla et al., 2019).

Conditional process analysis models containing mediation and moderation would require estimation of many unknown parameters to calculate power before any data are collected (Aberson et al., 2020), which is why the creator of the modeling tool (Hayes, 2018) gives little credence to attempts at power estimation. In another publication, Hayes (2022), recognizes moderated mediation's basis in regression, and points researchers to Fritz and MacKinnon's (2007) work comparing attempts at power analysis for many mediation methods. Aligned with a similar logic, other statisticians regularly utilize the regression tool in G*Power (Faul et al., 2007) and add predictors to account for the indirect effects created by moderating variables (Abbu & Gopalakrishna, 2021), or utilize a number of non-traditional methods to estimate statistical power on complex models (McQuitty, 2004). To both of these points, I have evaluated the tables in Fritz and MacKinnon's (2007) study, utilized G*Power, and consulted college to estimate the need for a sample size of 253. To account for estimated 16% attrition (Palan & Schitter, 2018), 301 subjects were contracted for this study.

The two models are each automatically corrected for inflated Type I error in the PROCESS macro. However, no corrections were made for experiment-wise error, such as the Bonferroni adjustment or false discovery rate (FDR) estimation. The hypotheses in the two models do not meet the criteria for a universal null hypothesis, as they do not combine to create a theoretically similar alternative hypothesis (Rubin, 2017); they are, by design, somewhat competitive in nature.

Data Cleaning and Post Hoc Power

The cleaning process involved multiple steps and criteria to refine the survey results. First, all respondents successfully passed the attention checks, confirming their attentiveness during the survey. However, two respondents who did not complete the survey were excluded from the final data set, and two replacement subjects were recruited to maintain an adequate sample size. The final data set was devoid of any missing values, indicating a complete data set, and no method for dealing with missing data (e.g., mean imputation, kNN) was needed. Additionally, response time was examined, and none of the responses were eliminated based on short duration. The mean (576.7 seconds) suggests that participants answered the survey questions at an acceptable rate of 6.48 seconds per question (Ward & Meade, 2023).

In addition to response time, the Careless package in R employed to identify careless responding (Yentes & Wilhelm, 2021). As a result, a total of 37 respondents were excluded from the analysis based on best practices and established cutoffs derived from prior studies of time (Malhotra, 2008; Ward & Meade, 2023), longstring measures (Yentes, 2020), the IRV (Dunn et al., 2018), and Mahalanobis distance (Ward & Meade, 2023).

After attrition and unusable data were accounted for, a final sample size of 264 was utilized for this study. *Post hoc* analysis utilizing G*Power reals a high probability of detecting an effect or relationship if it truly exists in the population ($1-\beta = .91$), a reduced likelihood of a Type II error, though this is only applicable to portions of the analysis, such as regression used to investigate direct relationships, as no power consensus for power analysis exists for conditional bootstrapping analysis of confidence intervals for mediation and moderation (Hayes, 2022).

CHAPTER 3

RESULTS

Descriptive Statistics

Summary statistics were calculated for the ALP-S (leader micro-climate), PS-7 (psychological safety), and TCI (team climate of innovation) in order to evaluate normality.

Summary Statistics

The observations from the ALP-S had an average of 4.47 (SD = 0.83, SEM = 0.05, min = 1.20, max = 6.00, skewness = -0.71, kurtosis = 0.83). The observations for the PS-7 had an average of 4.13 (SD = 0.41, SEM = 0.03, min = 2.86, max = 5.43, skewness = 0.19, kurtosis = 0.97). The observations for the TCI had an average of 4.03 (SD = 0.52, SEM = 0.03, min = 1.11, max = 5.00, skewness = -1.21, kurtosis = 3.57). The observations for the leader micro-climate of *purpose*, an ALP-S factor of interest, had an average of 4.47 (SD = 0.90, SEM = 0.06, min = 1.00, max = 6.00, skewness = -0.65, kurtosis = 0.57). The observations for the leader micro-climate of *change orientation*, another ALP-S factor of interest, had an average of 4.21 (SD = 0.98, SEM = 0.06, min = 1.00, max = 6.00, skewness = -0.47, kurtosis = -0.12). When the skewness is greater than 2 in absolute value, the variable is considered to be asymmetrical about its mean. When the kurtosis is greater than or equal to 3, then the variable's distribution is markedly different than a normal distribution in its tendency to produce outliers (Westfall &

Henning, 2013). The variables all fall within normal ranges, with the exception of the team climate of innovation, which was determined to be leptokurtic. The summary statistics may be found in Table 5. Bivariate correlations may be found in Table 6.

Table 5

Summary Statistics Table for Interval and Ratio Variables

Variable	M	SD	n	SE_M	Min	Max	Skewness	Kurtosis
Leader Micro-climate	4.47	0.83	264	0.05	1.20	6.00	-0.71	0.83
Psychological Safety	4.13	0.41	264	0.03	2.86	5.43	0.19	0.97
Team Climate of Innovation	4.03	0.52	264	0.03	1.11	5.00	-1.21	3.57
Purpose Micro-Climate	4.47	0.90	264	0.06	1.00	6.00	-0.65	0.57
Change Orientation Micro-climate	4.21	0.98	264	0.06	1.00	6.00	-0.47	-0.12

Table 6

Descriptive Statistics and Correlations for ALP-S Micro-climate Factors

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8
1. Purpose	264	4.47	0.90	–							
2. Energy	264	4.23	1.02	0.82	–						
3. Structure	264	4.71	0.83	0.69	0.59	–					
4. Change Orientation	264	4.21	0.98	0.80	0.80	0.55	–				
5. Individual Consideration	264	4.22	0.83	0.82	0.81	0.64	0.74	–			
6. Enablement	264	4.72	0.92	0.80	0.74	0.66	0.84	0.68	–		
7. Consideration	264	4.61	1.04	0.80	0.84	0.63	0.82	0.72	0.87	–	
8. Warmth	264	4.60	1.02	0.73	0.79	0.56	0.79	0.64	0.83	0.91	–

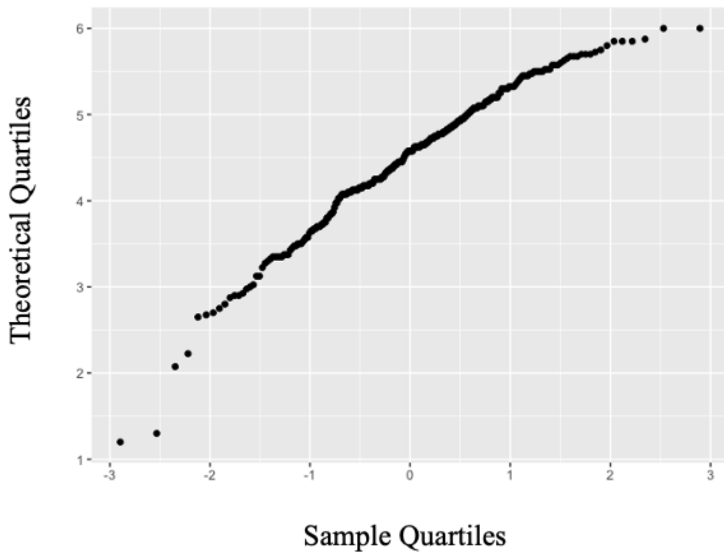
Note. All correlations are significant at the $p < .001$ level

Normality

The assumption of normality was assessed for each instrument by plotting the quantiles of the model residuals against the quantiles of a chi-square distribution, also called a Q-Q scatterplot (DeCarlo, 1997). For the assumption of normality to be met, the quantiles of the residuals must not strongly deviate from the theoretical quantiles. Strong deviations could indicate that the parameter estimates are unreliable. Looking first at the ALP-S; Figure 3 presents a Q-Q scatterplot of its residuals.

Figure 3

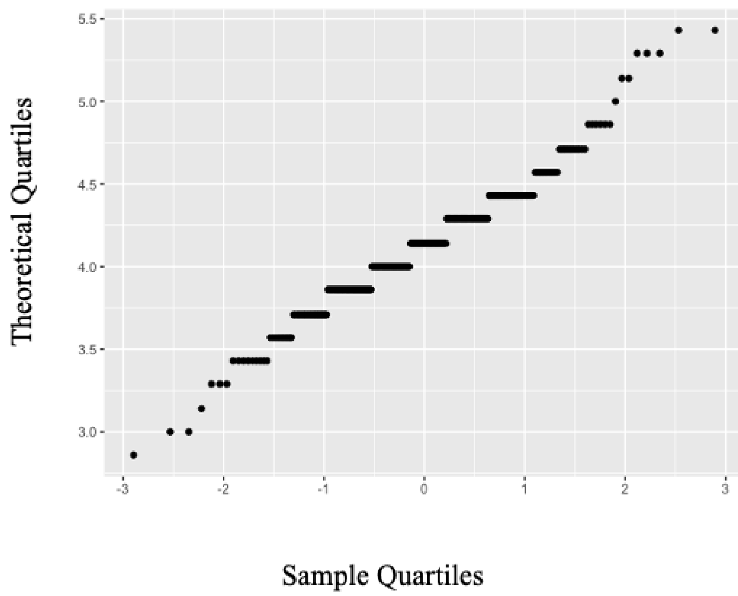
Q-Q Scatterplot for Normality of the Residuals for the ALP-S Survey



The ALP-S data was also evaluated with the Shapiro-Wilk test of normality. The data was found to be slightly abnormally distributed (W = 0.97, p < 0.001). The PS-7 data was also evaluated with the Shapiro-Wilk test of normality, see Figure 4. The data was found to be slightly abnormally distributed (W = 0.97, p = 0.0001).

Figure 4

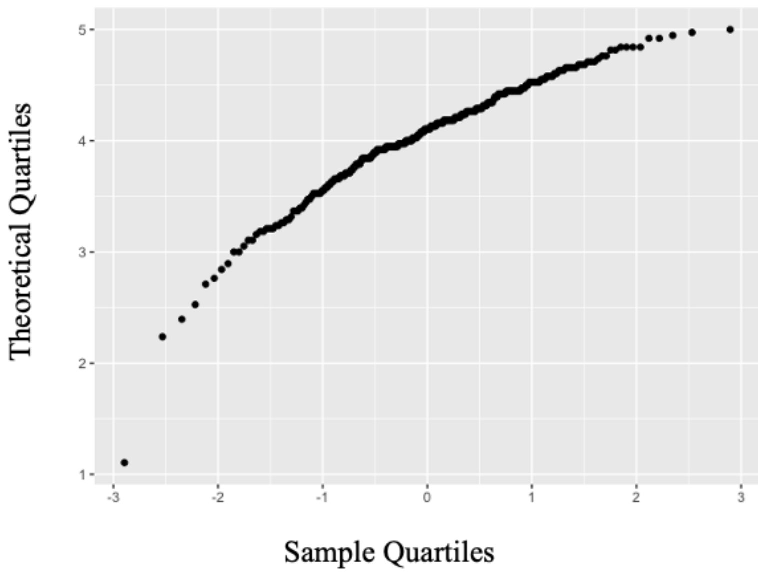
Q-Q Scatterplot for Normality of the Residuals for the PS-7 Survey



Finally, the TCI data was also evaluated with the Shapiro-Wilk test of normality, see Figure 5. The data was found to be somewhat abnormally distributed ($W = 0.94$, $p < 0.001$). In sum, all three measures were found to deviate slightly for normality, which is of no concern as only severe violations affect statistical inferences (Hayes, 2022).

Figure 5

Q-Q Scatterplot for Normality of the Residuals for the TCI Survey



Hypothesis 1: Mediation

A mediation analysis was conducted to assess if psychological safety mediated the relationship between the team members' evaluation of the leader's micro-climate and the team climate of innovation. Prior to the focal analysis, assumptions regarding homoscedasticity and multicollinearity were examined.

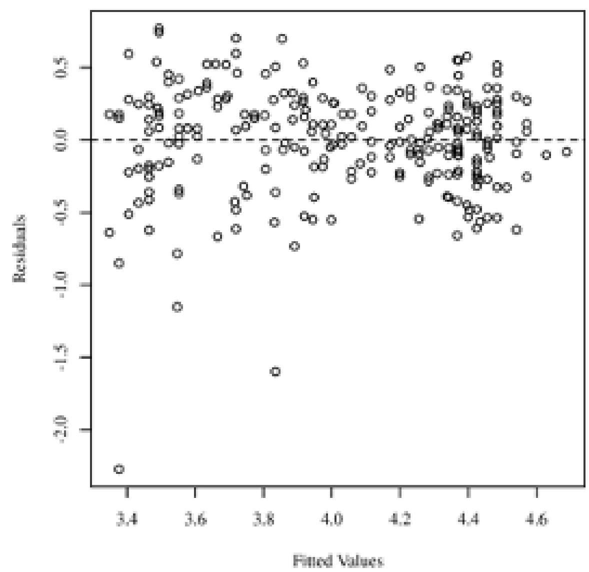
Assumptions

Homoscedasticity

Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2017; Osborne & Waters, 2002). The assumption of homoscedasticity is met if the points appear randomly distributed with a mean of zero and no apparent curvature. Figure 6 presents a scatterplot of predicted values and model residuals, with only a slight indication of heteroscedasticity, but not to a degree to cause hesitation (Field, 2017).

Figure 6

Residuals Scatterplot Testing Homoscedasticity



Multicollinearity

Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors. High VIFs indicate increased effects of multicollinearity in the model. VIFs greater than 5 are cause for concern, whereas VIFs of 10 should be considered the maximum upper limit (Menard, 2009). Multicollinearity did not appear to be an issue with this data; Table 7 presents the VIF for each predictor in the model.

Table 7

Variance Inflation Factors for Leader Micro-climate and Psychological Safety

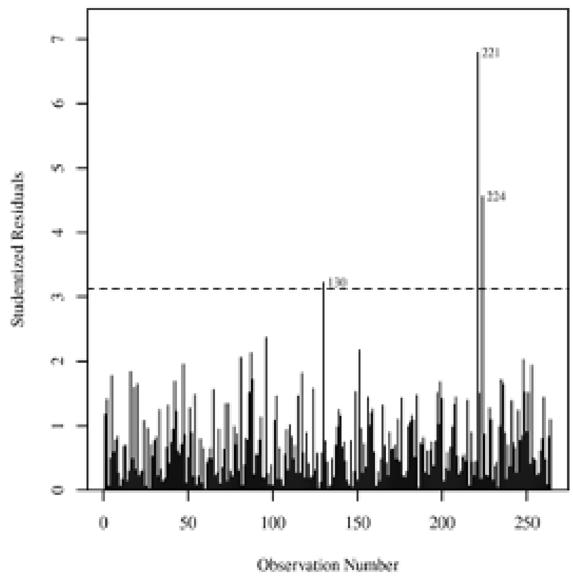
Variable	VIF
ALP-S	1.06
PS-7	1.06

Outliers

To identify influential data points, studentized residuals were calculated and the absolute values were plotted against the observed values (Field, 2017; Pituch & Stevens, 2015). Studentized residuals are calculated by dividing the model residuals by the estimated residual standard deviation. An observation with a studentized residual greater than 3.12 in absolute value, the 0.999 quantile of a *t* distribution with 263 degrees of freedom, was the criteria used to determine significant influence on the results of the model. Figure 3 presents the Studentized residuals plot of the observations. In Figure 7, observation numbers are shown next to each point with a studentized residual greater than 3.12 (three in total). These three outliers were not removed due to Hayes and colleagues' argument that models utilizing bootstrapped confidence intervals are resilient to the effects of outliers (Hayes, 2022; MacKinnon et al., 2004; Preacher & Hayes, 2004, 2008). Additionally, the outliers can hold within them useful information and should not be simply discarded without further cause (Aguinis et al., 2013).

Figure 7

Studentized Residuals Plot for Outlier Detection



Hypothesis 1a and 1b Results

Mediation was examined based on the examination of indirect and direct effects using bootstrapping (5000 samples) with percentile-based confidence intervals. The results are based on an α of .05. The regression model results are presented in Table 8 and Table 9.

Table 8

Results for the Regression on the Climate of Innovation

Variable	*B*	*SE*	95.00% CI	*t*	*p*
(Intercept)	4.03	0.02	[3.99, 4.08]	179.08	< .001
Leader Micro-climate (*c'*)	0.11	0.008	[0.10, 0.13]	14.94	< .001
Psychological Safety (*b*)	0.20	0.06	[0.08, 0.34]	3.60	<.001

$R^2 = .51$
$F(2, 261) = 137.58$, $p < .0001$

Table 9

Results for the Regression on Psychological Safety

Variable	B	SE	95.00% CI	t	p
(Intercept)	3.96×10^{-16}	0.02	[-0.05, 0.05]	0.00	1.000
Leader Micro-climate (*a*)	0.03	0.007	[0.02, 0.04]	3.81	< .001
$R^2 = .053$					
$F(1, 262) = 14.52$, $p = .0002$					

Direct Effect

The average direct effect of the leader's perceived encouragement of a diverse motivational micro-climate (i.e., more encouraged across a higher number of micro-climates) on the climate of innovation experienced by staff was significant, $B = 0.11$, 95.00% CI [0.10, 0.13], $p < .001$. This indicates that higher availability of leader micro-climate significantly predicted the team's climate of innovation, thus supporting Hypothesis 1a.

Indirect Effect

The average indirect effect for the leader micro-climate availability on the team climate of innovation through psychological safety was statistically significant, but not meaningful in a practical sense, $B = 0.006$, 95.00% CI [0.002, 0.012]. Although when psychological safety's mediating effect was evaluated on a standardized model, the indirect effect of the leader micro-climate availability on the team climate of innovation was practically significant, $\beta = 0.037$, 95.00% CI [0.012, 0.07]; see Table 10 for the indirect effects evaluated through bootstrapping confidence intervals. Standardizing the measure of the magnitude of the indirect effect makes it comparable across different studies and variables. It is calculated by dividing the indirect effect by the product of the standard deviations of the criterion and outcomes variables. This standardization process ensures that the completely standardized indirect effect is not influenced by the scale or units of measurement of the variables involved, which is useful in this case as the three instruments utilize different Likert-scale points (Preacher & Kelley, 2011). Therefore, the data supports Hypothesis 1b.

Table 10

Results for Bootstrapped Confidence Intervals Indicating the Indirect Effects of Leader Micro-climate on the Climate of Innovation

Variable	*B*	*SE*	95.00% CI
Psychological Safety	0.006	0.0025	[0.002, 0.12]
Psychological Safety, standardized	0.037	0.014	[0.012, 0.07]

Hypotheses 2-4: Moderated Mediation

A conditional process analysis (Hayes, 2022) was conducted to assess if team task orientation and team vision mediated the relationship between a leader's micro-climate of change orientation (leader change orientation) and the team's climate of innovation (team innovation). Moderated mediation was used to evaluate how the values of a leader's micro-climate of purpose (leader purpose) affect the indirect effect of leader change orientation on team innovation through the team's task orientation and vision factors within their overall climate of innovation. In this model, which can be seen in Figure 2, the path from leader change orientation to team innovation was moderated by a leader's micro-climate of purpose (leader purpose). Mean centering was used for the leader's change orientation micro-climate and a leader's purpose micro-climate. First, the results of tested assumptions will be presented, followed by the outcomes of hypothesis testing.

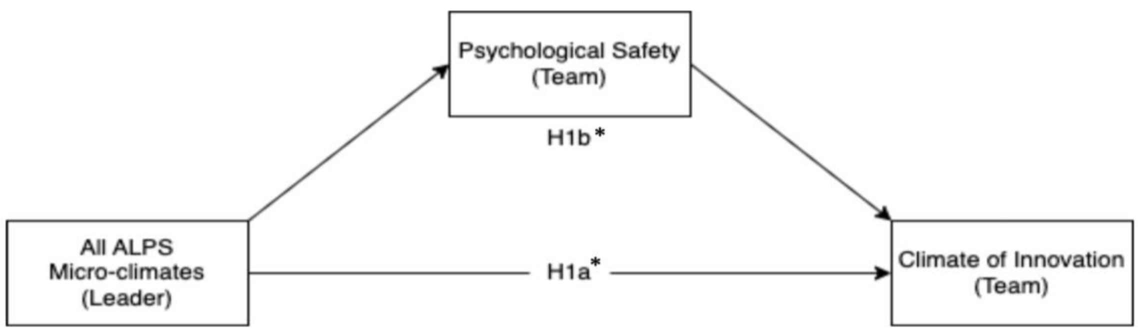
Assumptions

Homoscedasticity

Homoscedasticity was evaluated by plotting the residuals against the predicted values (Bates et al., 2014; Field, 2017; Osborne & Waters, 2002). The points appear randomly distributed with a mean of zero and no apparent curvature, thus appearing to meet the assumption for homoscedasticity. Figure 8 presents a scatterplot of predicted values and model residuals indicating a homoscedastic distribution.

Figure 8

Hypothesis 1 Results



Note. * = significant effect, indicating a supported hypothesis.

Multicollinearity

Variance Inflation Factors (VIFs) were calculated to detect the presence of multicollinearity between predictors. High VIFs indicate increased effects of multicollinearity in the model. VIFs greater than 5 are cause for concern, whereas VIFs of 10 should be considered the maximum upper limit (Menard, 2009). The following predictors had VIFs greater than 10: leader micro-climate of change orientation, and the leader micro-climate of purpose. Although the VIF are higher than the upper limit, in certain cases multicollinearity may still occur when variables are highly related but distinct (Porter & Gujarati, 2008). This can be expected among the leader micro-climates due to constraints on the model owing to underlying theoretical similarities, such as in the case of personality facets (Hittner, 2000). Similarly, the two factors leader micro-climate factors both measure climates relating to the somatic pairs of motivational states (Apter, 2001). Even so, the observed multicollinearity observed with these variables may be of lesser concern in the current analysis as they are not predictor variables that are interpreted independently in a standard multiple regression. Multicollinearity does not affect the interpretation of an entire model (the R^2), but may produce unreliable probability values and confidence intervals of the individual regression coefficients (Harrell, 2001). In addition, the predictor variable, change orientation, and a moderating variable, purpose, are tested to produce individual coefficient estimates to test hypotheses, rather, bootstrapped confidence intervals are used to investigate the impact of purpose. Thus, no claims are made regarding the coefficient estimates of these variables. Finally, multicollinearity does not affect bootstrapping confidence intervals to test for interactions (Hayes, 2022). More detail regarding the process and purpose of these variables with high VIF is covered in the following results for Hypothesis 4a, 4b, and 4c. Table 11 presents the VIF for each predictor in the model.

Table 11

Variance Inflation Factors for Team Task Orientation, Team Vision, and Leader Change Orientation, Leader Vision

Variable	VIF
Team task orientation	2.18
Team vision	1.82
Leader change orientation	17.37
Leader purpose	12.33

Outlier

To identify influential points, studentized residuals were calculated and the absolute values were plotted against the observation numbers (Field, 2017; Pituch & Stevens, 2015). Studentized residuals are calculated by dividing the model residuals by the estimated residual standard deviation. An observation with a Studentized residual greater than 3.12 in absolute value, the 0.999 quantile of a *t* distribution with 263 degrees of freedom, was considered to have significant influence on the results of the model. Figure 9 presents the studentized residuals plot of the data points. These three outliers were not removed due to Hayes and colleagues' argument that models utilizing bootstrapped confidence intervals are resilient to the effects of outliers (Hayes, 2022; MacKinnon et al., 2004; Preacher & Hayes, 2004, 2008). Additionally, the outliers can hold within them useful information and should not be simply discarded without further cause (Aguinis et al., 2013). Results for Hypotheses 1a and 1b are illustrated in Figure 10.

Figure 9

Residuals Scatterplot Testing Homoscedasticity

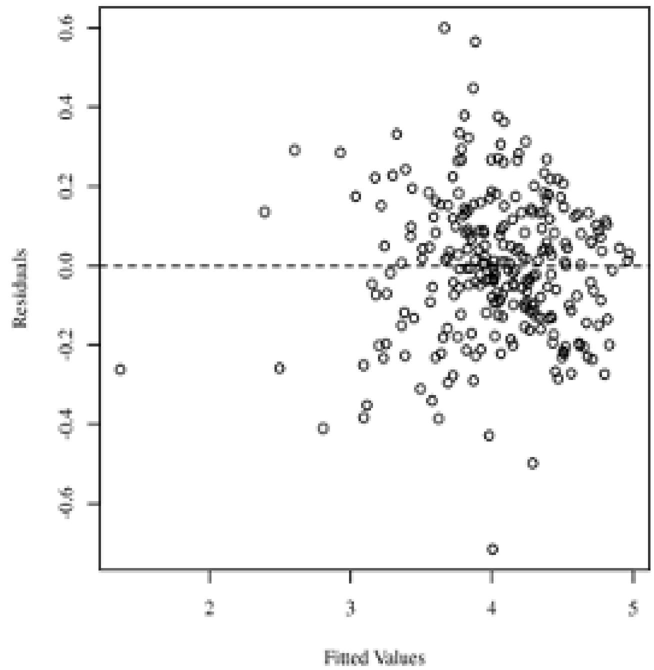
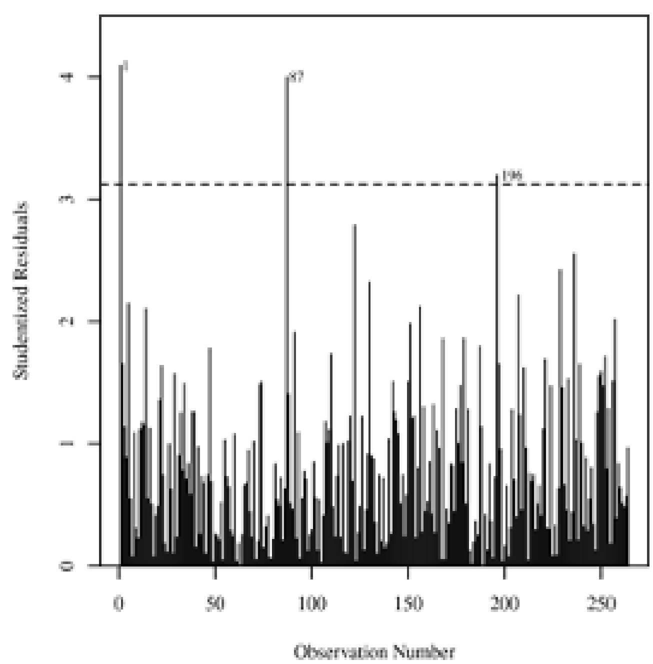


Figure 10

Studentized Residuals Plot for Outlier Detection



Hypotheses 2-4 Results

Mediation was examined based on the indirect and direct effects using bootstrapping with percentile-based confidence intervals, and moderated mediation was examined by looking at the index of moderated mediation using bootstrapping with percentile-based confidence intervals (Hayes, 2022). Simple slopes analysis was used to examine any significant effects the leader's purpose had on the indirect effects. The results are based on an α of .05. The regression model results are presented in Table 12, Table 13, and Table 14.

Table 12

Results for the Regression on the Team Climate of Innovation

Variable	*B*	*SE*	95.00% CI	*t*	*p*
(Intercept)	1.11	0.11	[0.89, 1.34]	9.69	< .001
Team Task Orientation (b_1)	0.34	0.03	[0.29, 0.40]	12.48	< .001
Team Vision (b_2)	0.40	0.02	[0.35, 0.44]	16.45	< .001
Leader Change Orientation (c_1)	0.09	0.02	[0.05, 0.13]	4.38	< .001
Leader Purpose (c_2)	0.02	0.02	[-0.03, 0.06]	0.68	.50
Leader Change Orientation * Purpose (c_3)	-0.02	0.010	[-0.04, 0.002]	-1.82	.070

$R^2 = .8811$
$F(5, 258) = 382.29$, $p < .0001$

Table 13

Results for the Regression on Team Task Orientation

Variable	*B*	*SE*	95.00% CI	*t*	*p*
(Intercept)	2.35	0.21	[1.93, 2.77]	11.04	< .001
Leader Change Orientation (a_1)	0.28	0.04	[0.20, 0.37]	6.52	< .001
Leader Purpose (a_3)	0.03	0.05	[-0.07, 0.13]	0.62	.534
Leader Change Orientation * Purpose (a_4)	0.004	0.02	[-0.04, 0.04]	-0.19	.85
R^2 = .5420 $F(4, 259) = 76.63$, $p < .0001$					

Table 14

Results for the Regression on Team Vision

Variable	*B*	*SE*	95.00% CI	*t*	*p*
(Intercept)	4.19	0.04	[4.12, 4.26]	114.68	< .001
Leader Change Orientation (a_2)	0.07	0.05	[-0.04, 0.17]	1.29	.20
Leader Purpose (a_5)	0.35	0.06	[0.23, 0.47]	5.88	< .001
Leader Change Orientation * Purpose (a_6)	-0.02	0.03	[-0.08, 0.03]	-0.76	.448
R^2 = .3633 $F(3, 260) = 49.45$, $p < .0001$					

Direct Effects

The average direct effect between leader change orientation and team climate of innovation (c_1) was significant, B = 0.09, 95.00% CI [0.05, 0.13], $p < .001$. This indicates that a higher reported micro-climate of leader change orientation significantly predicted the team's climate of innovation, thus supporting Hypothesis 2. The average direct effect between leader change orientation and team task orientation (a_1) was significant, B =

0.28, 95.00% CI [0.20, 0.38], $p < .001$. These results, supplemented by the conditional indirect effects for task orientation (see Table 16), support Hypothesis 3a. The average direct effect between leader change orientation and vision was not significant, $B = 0.07$, 95.00% CI [-0.04, 0.17], $p = .20$, thus failing to support Hypothesis 3b.

Indirect Effect

The indirect paths for the leader's micro-climate of change orientation on the team climate of innovation through the team's task orientation and vision were moderated, so conditional indirect effects were evaluated instead.

Index of Moderated Mediation

The indices of moderated mediation were used to determine if there was any significant moderated mediation in the mediation analysis using bootstrapping with 95.00% confidence intervals. The index of moderated mediation for team task orientation was not significant, index = -0.002, 95.00% CI [-0.02, 0.02]. This indicates that the indirect effect of the leader change orientation micro-climate on the team climate of innovation through team task orientation was independent of the values of the leader micro-climate of purpose. The index of moderated mediation through team vision was not significant, index = -0.008, 95.00% CI [-0.05, 0.03]. This indicates that the indirect effect of the leader change orientation micro-climate on team climate of innovation through team vision was independent of the values of the leader micro-climate of purpose.

Conditional Direct Effects

For the conditional direct effects of the leader's micro-climate of change orientation on the team climate of innovation, the leader micro-climate of purpose was examined at one standard deviation below the mean (3.58), at the mean (4.47) and one standard deviation above the mean (5.37). With the leader micro-climate of purpose fixed at 3.58, the slope of the direct effect was significant with a value of 0.11, 95.00% CI [0.06, 0.15], $t = 4.86$, $p < .001$. With the leader micro-climate of purpose fixed at 4.47, the slope of the direct effect was significant with a value of 0.09, 95.00% CI [0.05, 0.13], $t = 4.38$, $p < .001$. With the leader micro-climate of purpose fixed at 5.37, the slope of the direct effect was significant with a value of 0.07, 95.00% CI [0.03, 0.12], $t = 3.23$, $p = .001$. This indicates that as the leader micro-climate of purpose increases in value, the slope of the direct effect decreases. These results fail to reject the null hypothesis for Hypothesis 4c, indicating the influence operates in the opposite direction than hypothesized. The results of the simple slopes analysis for the direct effects may be seen in Table 15.

Table 15

Conditional Direct Effects of Leader Change Orientation on Team Climate of Innovation Moderated by Leader Purpose

Values of Leader Purpose Micro-climate	*B*	95.00% CI	*SE*	*t*	*p*
3.58 (-1 SD)	0.11	[0.06, 0.15]	0.02	4.86	< .001
4.47 (mean)	0.09	[0.05, 0.13]	0.02	4.38	< .001
5.37 (+1 SD)	0.07	[0.03, 0.12]	0.02	3.23	.001

Conditional Indirect Effects for Task Orientation

For the indirect effect of the leader micro-climate of change orientation on the team climate of innovation through team task orientation, leader micro-climate of purpose was examined at one standard deviation below the mean (3.58), at the mean

(4.47) and one standard deviation above the mean (5.37). With purpose fixed at 3.58, the slope of the indirect effect of task orientation was significant with a value of 0.10, 95.00% CI [0.06, 0.14]. With purpose fixed at 4.47, the slope of the indirect effect of task orientation was significant with a value of 0.10, 95.00% CI [0.06, 0.13]. With purpose fixed at 5.37, the slope of the indirect effect of task orientation was significant with a value of 0.10, 95.00% CI [0.06, 0.14]. This indicates that as leader micro-climate of purpose increases in value, the slope of the indirect effect is unchanged. These results fail to reject the null hypothesis for Hypothesis 4a, and thus, the hypothesis was not supported. The results of the simple slopes analysis for the indirect effects are shown in Table 16.

Table 16

Conditional Indirect Effects of Leader Change Orientation on Team Climate of Innovation through Team Task Orientation Moderated by Leader Purpose

Values of Leader Purpose Micro-climate	*B*	95.00% CI
3.58 (-1 SD)	0.10	[0.06, 0.14]
4.47 (mean)	0.10	[0.06, 0.13]
5.37 (+1 SD)	0.10	[0.06, 0.14]

Conditional Indirect Effects for Vision

For the indirect effect of the leader micro-climate of change orientation on the team climate of innovation through team vision, the leader micro-climate of purpose was examined at one standard deviation below the mean (3.58), at the mean (4.47) and one standard deviation above the mean (5.37). With the leader micro-climate of purpose fixed at 3.58, the slope of the indirect effect of team vision was not significant with a value of

0.03, 95.00% CI [-0.02, 0.09]. With the leader micro-climate of purpose fixed at 4.47, the slope of the indirect effect of team vision was not significant with a value of 0.03, 95.00% CI [-0.009, 0.07]. With the leader micro-climate of purpose fixed at 5.37, the slope of the indirect effect of team vision was not significant with a value of 0.02, 95.00% CI [-0.03, 0.08]. These results fail to reject the null hypothesis for Hypothesis 4b and thus, not supporting the hypothesized effect. The results of the simple slopes analysis for the indirect effects can be seen in Table 17.

Table 17

Conditional Indirect Effects of Leader Change Orientation on Team Climate of Innovation through Team Vision Moderated by Leader Purpose

Values of Leader Purpose Micro-climate	*B*	95.00% CI
3.58 (-1 SD)	0.03	[-0.02, 0.09]
4.47 (mean)	0.03	[-0.009, 0.07]
5.37 (+1 SD)	0.02	[-0.03, 0.08]

Conditional Indirect Effects for Task Orientation and Vision

For the indirect effect of the leader micro-climate of change orientation on the team climate of innovation through team task orientation and team vision, the leader micro-climate of purpose was examined at one standard deviation below the mean (3.58), at the mean (4.47) and one standard deviation above the mean (5.37). With the leader micro-climate of purpose fixed at 3.58, the slope of the indirect effect of team vision and task orientation was not significant with a value of 0.01, 95.00% CI [-0.04, 0.03]. With the leader micro-climate of purpose fixed at 4.47, the slope of the indirect effect of team vision and orientation was not significant with a value of 0.08, 95.00% CI [-0.003, 0.02].

With the leader micro-climate of purpose fixed at 5.37, the slope of the indirect effect of team vision and orientation was not significant with a value of 0.006, 95.00% CI [-0.01, 0.02]. These results, along with the aforementioned results for Hypothesis 3b, do not provide sufficient evidence to support Hypothesis 3c. The results of the simple slopes analysis for the indirect effects can be seen in Table 18. Figure 11 provides a summary of results for Hypotheses 2-4.

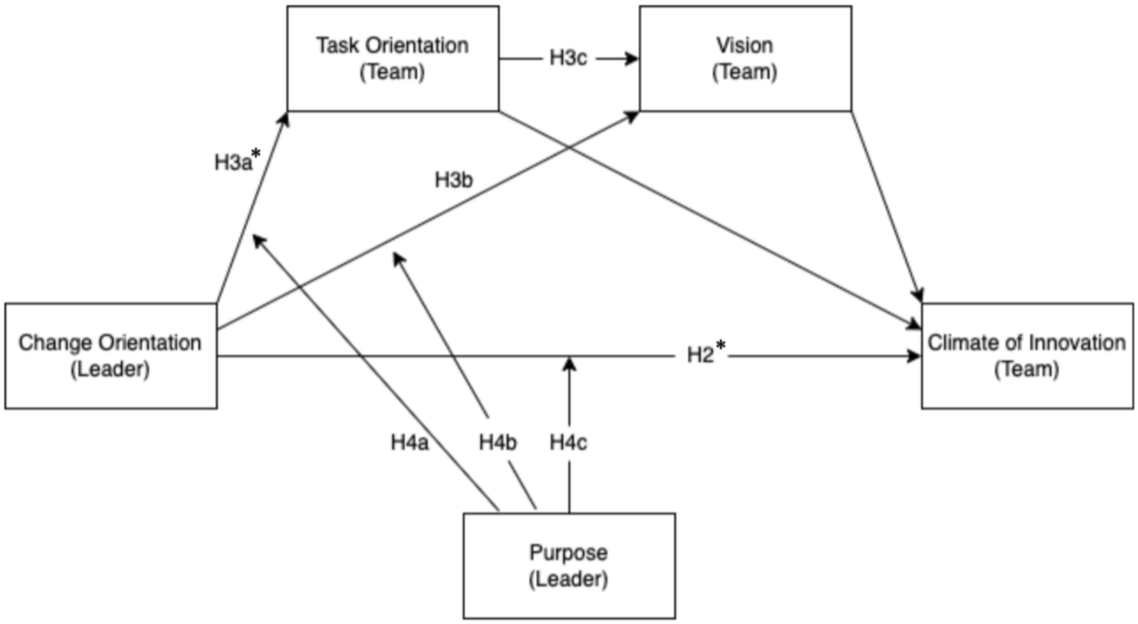
Table 18

Conditional Indirect Effects of Leader Change Orientation on Team Climate of Innovation through Team Task Orientation and Team Vision Moderated by Leader Purpose

Values of Leader Purpose Micro-climate	*B*	95.00% CI
3.58 (-1 SD)	0.03	[-0.02, 0.09]
4.47 (mean)	0.03	[-0.009, 0.07]
5.37 (+1 SD)	0.02	[-0.03, 0.08]

Figure 11

Hypothesis 2-4 Results



Note. * = significant effect, indicating a supported hypothesis.

CHAPTER 4

DISCUSSION

Implications for Theory

Teams are intricate entities that give rise to complex states and processes that are often challenging to discern when examined solely at the individual or organizational level, so careful consideration was given to the most effective approach for investigating variables. Consequently, as advocated by Klein and Kozlowski (2000), the present study investigates both the individual contribution of the leader to the team climate, the micro-climate, and the team's propensity for innovation, at the group level of analysis. Prior studies have consistently shown that team climate serves as a robust predictor for various team outcomes, with its dynamics heavily influenced by team leaders (Hughes et al., 2018; Hunter et al., 2007; Mathieu et al., 2019a; Stollberger et al., 2019), but no studies have investigated the application of the psychodiversity hypothesis (Alfonso & McDermott, 2020; Apter, 2001) to the micro-climate encouraged by the leader (Apter & Carter, 2001, 2002). The leader's influence emerges as a strong predictor and moderator of team climate, particularly in the context of innovation (Hughes et al., 2018; Kozlowski & Ilgen, 2006; Scott & Bruce, 1994), but the mechanism for this influence is found wanting when surveying the body of leadership theories, which are more descriptive than explanatory in nature (Lord et al., 2017), or conflate behaviors with cognitive characteristics (Banks et al., 2021).

The results obtained from the present study support the notion that leaders with a more versatile micro-climate, fostering more motivational micro-climates (Apter, 2001; Apter & Carter, 2002; Carter & Kourdi, 2003), are more likely to have teams whose members report a higher team climate of innovation, which was the primary exploratory focus of the research. However, it is essential to note that while Hypothesis 1a received substantial support B = 0.11, 95.00% CI [0.10, 0.13], p< .001, it alone is insufficient to establish the validity of the psychodiversity hypothesis proposed by Apter (2001) as a team-level leadership construct. Nevertheless, these findings present a compelling rationale for further investigation, especially if future works were to employ a quasi-experimental causal design. In this discussion, we delve into the significance of these and other results, address their limitations, and outline potential avenues for future research to gain deeper insights into the complex relationship between motivational micro-climates and team-level leadership.

Participative safety, a factor of the team climate of innovation, includes trust in the leader, psychological safety, and interpersonal support. Psychological safety is a contextual element that may facilitate the formation of the protective frame - a theoretical assumption explored in this study. In other contexts, forming a protective frame allows one to approach emotionally burdensome or high-stakes tasks with a positive mindset (Alfonso & McDermott, 2020). Since leader influence on psychological safety has been repeatedly supported (Frazier et al., 2017), and psychological safety has a relationship with innovation (Edmondson & Lei, 2014; Hülsheger et al., 2009), and this study reinforces the known relationship between psychological safety and the climate of innovation, $B = 0.20$, 95.00% CI [0.08, 0.34], $p < .001$. The hypothesis (1b) about leader micro-climate diversity, or availability, and the team climate of innovation being partially mediated by psychological safety was supported statistically, $B = 0.03$, 95.00% CI [0.02, 0.04], $p < .001$. The small effect indicates that psychological safety is a weaker link in the causal chain between the leader's versatility in fostering motivational states and an innovative team climate. Future studies should investigate the relationship between psychological safety and each motivational micro-climate of the leader to better understand the path through which the leader impacts psychological safety.

In addition to applying the psychodiversity hypothesis to group innovation in a work context, this study also drew from the reversal theory literature regarding the rebellious motivational state (Apter, 2001; McDermott, 2001) and investigated it in the work team context as the change orientation micro-climate fostered by the leader (Apter & Carter, 2001, 2002). Analysis of the data supported Hypothesis 2, the positive connection between the change orientation micro-climate of the leader and the team climate of innovation, $B = 0.09$, 95.00% CI [0.05, 0.13], $p < .001$.

Vision, a factor of the team climate of innovation, was investigated for a potential mediating role between the charge orientation micro-climate of the leader and the team climate of innovation due to its connection with the leader. As no support was found for this connection (H3b), clearly defined, higher-order goals contributing to the innovative climate do not appear to emanate from the leader change orientation micro-climate. Perhaps, the contrasting micro-climate of structure (conforming state) and purpose (telic state) are more related to the vision factor of the team climate of innovation. Similarly, the mediating role of task orientation between leader change orientation and the team climate of innovation was examined. The direct relationship between the leader change orientation micro-climate and team task orientation climate factor was found to be significant, *B* = 0.28, 95.00% CI [0.20, 0.38] , $p < .001$. Also supported was team task orientation's role as a partial mediator between the leader change orientation micro-climate and the overall team climate of innovation, *B* = 0.10, 95.00% CI [0.06, 0.13], $p < .001$. Both of these findings support Hypothesis 3a. The effects of serial mediation of these team climate factors were found to have no effect; hence, Hypothesis 3c was not supported by the data.

The moderating effects of the leader micro-climate of purpose on the relationship between leader change orientation and the task orientation and vision factors of the team climate of innovation were examined, and a moderating effect was not found in all three relationships. The combined telic-rebellious climate was hypothesized to result in a goal-oriented innovation, but the results did not support the hypothesized relationship. Thus, Hypotheses H4a, b, and c were not supported. This result could be due to goal orientation causing the consequences of mediocre or poor performance to be too salient in the team members' minds. Thus, rather than strengthening the relationship between the predictor and criterion variables by adding purpose to a climate characterized by change and rebellion, the micro-climate of purpose does nothing, as in the cases of Hypotheses 4a and 4b, or even works to weaken the relationship, as in the case of Hypothesis 4c. Another reason could be distinct from theory and simply due to error in the instrument utilized to test the construct; it could be that the ALP-S has unintentionally included a degree of purpose into all sub-factors due to the nature of the work environment and the role of a leader or manager. The moderating effects of the theoretical counterpart, the paratelic state, or leader micro-climate of energy, is an opportunity for exploration in future studies. A sense of enthusiasm and present attention to the task may instead foster innovation, but perhaps at the risk of reducing performance in standard tasks (Bowen et al., 2010).

Limitations and Future Directions

This study shares the inherent limitations that need to be considered when interpreting the findings of any cross-sectional, correlational research investigation. First, the non-experimental nature of these studies precludes the establishment of causality or the ability to infer the directionality of relationships between variables (Shadish et al., 2002). Additionally, cross-sectional designs capture data at a single point in time, which may fail to account for temporal changes or developmental trajectories of the variables under investigation (Bowers et al., 2013). Furthermore, common method bias poses a potential concern, as data collected from a single source using self-report measures may introduce shared method variance, leading to inflated relationships among variables (Lindell & Whitney, 2001). Another limitation to consider was the use of online paid samples, which may introduce biases and limit the generalizability of findings to the broader population (Peer et al., 2017). It should also be noted that this study tested the variables in accordance with the general linear model, and any non-linear relationships in the data remain unexamined (Field, 2017). Lastly, simpler models may provide a clearer path for the implementation of findings.

A potential limitation of this study, and an area in need of further investigation, is the operationalization of the psychodiversity, or versatility, of the leader micro-climate utilized in Hypothesis 1. Specifically, the validity and psychometric properties of the 0-8 scoring protocol for each leader should be examined. One approach to investigating the validity of the metric would involve the development of a new omnibus measure specifically and directly ask team members' perceptions of the psychodiversity of the micro-climate encouraged by their leader. Assuming the reliability and validity of this new scale is itself established, a correlational analysis would be used to evaluate whether the scoring technique used in the present study is positively related to team members' global assessment of micro-climate psychodiversity afforded by the leader. An additional approach would be to analyze the scores via a CHAID (Chi-squared Automatic Interaction Detection) analysis. CHAID, a decision tree-based algorithm commonly used for exploratory data analysis and predictive modeling, is primarily designed for categorical variables, but it may be adapted to handle interval data through a process called discretization or binning (Kass, 1980). The process of discretization can be done in several ways, depending on the nature of the data and the goals of the analysis; optimal binning may be the best route as it can help identify the most important variables in the dataset and create a hierarchy of their predictive power, which will provide a more nuanced understanding of the micro-climate combinations (Navas-Palencia, 2020). A CHAID analysis may uncover interesting relationships between the availability of motivational micro-climates afforded by the leader and the team climate of innovation.

These limitations underscore the importance of cautious interpretation and the need for complementary research designs to provide more robust evidence for causal relationships and minimize potential biases. Therefore, any practical application of the studies finding should be approached guardedly. Future studies should seek to replicate this study while mitigating these limitations through time series data capture and a mixed methods approach. Researchers should also investigate the relationship between the leader's energy micro-climate and the team's climate of innovation, and other outcomes associated with leaders who foster a diverse micro-climate, such as performance, wellbeing, job satisfaction, and engagement.

Conclusions

This study aimed to explore the role of psychological climate within work teams, with particular emphasis on team leaders who foster a climate conducive to innovation. The analyses examined leaders who indicate motivational versatility by fostering a diverse micro-climate and those primarily fostering a micro-climate of change orientation. Additionally, the mediating role of psychological safety and the moderating role of a leader's micro-climate of purpose was evaluated. Results showed that a diverse micro-climate of the leader and, more narrowly, the change orientation micro-climate both indicate the presence of a predictor criterion relationship. The limitations presented, and the suggested future direction provide caution to implementing these results and call for more research on these closely related topics.

REFERENCES

Abbu, H. R., & Gopalakrishna, P. (2021, March). Synergistic effects of market orientation implementation and internalization on firm performance: Direct marketing service provider industry. *Journal of Business Research*, *125*, 851–863. https://doi.org/10.1016/j.jbusres.2019.06.004

Aberson, C. L., Bostyn, D. H., Carpenter, T., Conrique, B. G., Giner-Sorolla, R., Lewis, N. A. J., Montoya, A. K., Ng, B. W., Schoemann, A. M., & Soderberg, C. (2020). Techniques and solutions for sample size determination in psychology: a critical review. Retrieved from https://osf.io/3zv8x

Aguinis, H., Gottfredson, R. K., & Joo, H. (2013). Best-practice recommendations for defining, identifying, and handling outliers. *Organizational Research Methods*, *16*(2), 270–301. https://doi.org/10.1177/1094428112470848

Alfonso, D. L., & McDermott, M. R. (2020). *Individual differences in psychodiversity and the relationship with resilience, well-being and coping from self-report measures*. Undergraduate BSc Psychology final year research project, University of East London.

Amabile, T. M. (1993). Motivational synergy: Toward new conceptualizations of intrinsic and extrinsic motivation in the workplace. *Human Resource Management Review*, *3*(3), 185–201. https://doi.org/10.1016/1053-4822(93)90012-s.

Amabile, T. M. (1996, January). *Creativity and innovation in organizations*. Harvard Business Review: Case Studies. https://www.hbs.edu/faculty/Pages/item.aspx?num=13672

Amabile, T. M., Barsade, S. G., Mueller, J. J., & Staw, B. M. (2005). Affect and creativity at work. *Administrative Science Quarterly*, *50*(3), 367–403. https://doi.org/10.2189/asqu.2005.50.3.367

Amabile, T. M., & Pratt, M. G. (2016). The dynamic componential model of creativity and innovation in organizations: Making progress, making meaning. *Research in Organizational Behavior*, *36*, 157–183. https://doi.org/10.1016/j.riob.2016.10.001

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework *Journal of Management*, *40*(5), 1297–1333. https://doi.org/10.1177/0149206314527128

Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: Development and validation of the team climate inventory. *Journal of Organizational Behavior*, *19*(3), 235–258. https://doi.org/10.1002/(sici)1099-1379(199805)19

Apter, M. J. (2001). Motivational styles in everyday life: A guide to reversal theory. In *American Psychological Association eBooks*. https://doi.org/10.1037/10427-000

Apter, M. J. (2005). *Personality dynamics: Key concepts in reversal theory*. Loughborough, UK: Apter International Ltd.

Apter, M. J. (2007). *Reversal Theory: The dynamics of motivation, emotion and personality*. Oneworld Publications.

Apter, M. J., & Carter, S. (2001). Management and organizations. In M. J. Apter (Ed.), *Motivational styles in everyday life: A guide to reversal theory* (pp. 251–262). American Psychological Association. https://doi.org/10.1037/10427-013

Apter, M. J., & Carter, S. (2002). Mentoring and motivational versatility: An exploration of reversal theory. *Career Development International*, *7*(5), 292-295.

Banks, G. C., Woznyj, H. M., & Mansfield, C. A. (2021). Where is “behavior” in organizational behavior? A call for a revolution in leadership research and beyond. *The Leadership Quarterly*, 101581. https://doi.org/10.1016/j.leaqua.2021.101581

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4: arXiv preprint arXiv, *Journal of Statistical Software*. https://doi.org/10.18637/jss.v067.io1

Beals, E., & Nye, C. (2017). *Missing data. In S. Rogelberg (Ed.), The SAGE encyclopedia of industrial and organizational psychology, 2nd edition* (pp. 956-958). SAGE Publications, Inc, https://dx.doi.org/10.4135/9781483386874.n329

Bergman, J. Z., Rentsch, J. R., Small, E. E., Davenport, S. W., & Bergman, S. M. (2012). The shared leadership process in decision-making teams. *The Journal of Social Psychology*, *152*(1), 17–42. https://doi.org/10.1080/00224545.2010.538763

Binnewies, C., & Wörnlein, S. C. (2011). What makes a creative day? A diary study on the interplay between affect, job stressors, and job control. *Journal of Organizational Behavior, 32*(4), 589–607. https://doi.org/10.1002/job.731

Bliese, P. D., Maltarich, M. A., Hendricks, J. L., Hofmann, D. A., & Adler, A. B. (2019). Improving the measurement of group-level constructs by optimizing between-group differentiation. *Journal of Applied Psychology*, *104*(2), 293–302. https://doi.org/10.1037/apl0000349

Boag, S. (2018). Personality dynamics, motivation, and the logic of explanation. *Review of General Psychology*, *22*(4), 427–436. https://doi.org/10.1037/gpr0000150

Bowen, F., Rostami, M., & Steel, P. (2010). Timing is everything: A meta-analysis of the relationships between organizational performance and innovation. *Journal of Business Research*, *63*(11), 1179–1185. https://doi.org/10.1016/j.jbusres.2009.10.014

Bowers, D., House, A., Owens, D., & Bewick, B. (2013). *understanding clinical papers*. John Wiley & Sons.

Byrne, B. M. (2010). *Structural equation modeling with amos: basic concepts, applications, and programming* (2nd ed.). New York: Taylor and Francis Group.

Carter, S., & Kourdi, J. (2003). *The road to audacity: Being adventurous in life and work*. NewYork: Palgrave Macmillan.

Cattell, R. B. (1957). *Personality and motivation structure and measurement.* World Book Co.

Chalmers, R. P., & Adkins, M. C. (2020). Writing effective and reliable Monte Carlo simulations with the simdesign package. *The Quantitative Methods for Psychology*, *16*(4), 248–280. https://doi.org/10.20982/tqmp.16.4.p248

Chan, D. (2019). Team-level constructs. *Annual Review of Organizational Psychology and Organizational Behavior*, *6*(1), 325–348. https://doi.org/10.1146/annurev-orgpsych-012218-015117

Chandler, J., Paolacci, G., Peer, E., Mueller, P., & Ratliff, K. A. (2015). Using nonnaive participants can reduce effect sizes. *Psychological Science, 26*(7), 1131–1139. https://doi.org/10.1177/0956797615585115

Chen, G., Kirkman, B. L., Kanfer, R., Allen, D., & Rosen, B. (2007). A multilevel study of leadership, empowerment, and performance in teams. *Journal of Applied Psychology*, *92*(2), 331–346. https://doi.org/10.1037/0021-9010.92.2.331

Csikszentmihalyi, M. (2014). Applications of flow in human development and education. In *Springer eBooks*. https://doi.org/10.1007/978-94-017-9094-9

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology, 56*(5), 815–822. https://doi.org/10.1037/0022-3514.56.5.815

DeCarlo, L. T. (1997). On the meaning and use of kurtosis. *Psychological Methods,* 2(3), 292-307. https://doi.org/10.1037/1082-989X.2.3.292

Deci, E. L., Olafsen, A. H., & Ryan, R. M. (2017). Self-determination theory in work organizations: The state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, *4*(1), 19–43. https://doi.org/10.1146/annurev-orgpsych-032516-113108

Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. Berlin: Springer Science & Business Media. https://doi.org/10.1007/978-1-4899-2271-7

Desselles, M. L., & Apter, M. J. (2013). Manipulating motivational states: A review. *Journal of Motivation, Emotion, and Personality: Reversal Theory Studies*, *1*. https://doi.org/10.12689/jmep.2013.106

Desselles, M. L., & Crum, B. (2019, July 10-12). A confirmatory factor analysis of the Apter leadership profile (ALP). *Reversal Theory Society Conference*, New Mexico.

DeYoung, C. G. (2015). Cybernetic big five theory. *Journal of Research in Personality*, *56*, 33–58. https://doi.org/10.1016/j.jrp.2014.07.004

Drescher, G., & Garbers, Y. (2016). Shared leadership and commonality: A policy-capturing study. *The Leadership Quarterly*, *27*(2), 200–217. https://doi.org/10.1016/j.leaqua.2016.02.002

Dunn, A. D., Heggestad, E. D., Shanock, L. R., & Theilgard, N. (2018). Intra-individual response variability as an indicator of insufficient effort responding: Comparison to other indicators and relationships with individual differences. *Journal of Business and Psychology*, *33*(1), 105–121. https://doi.org/10.1007/s10869-016-9479-0

Edmondson, A. (1999, June). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Edmondson, A. C., & Lei, Z. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. *Annual Review of Organizational Psychology and Organizational Behavior*, *1*(1), 23–43. https://doi.org/10.1146/annurev-orgpsych-031413-091305

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. *Psychological Methods*, *12*(1), 1–22. https://doi.org/10.1037/1082-989x.12.1.1

Ehrhart, M. G., & Schneider, B. (2016). Organizational climate and culture. *Oxford Research Encyclopedia of Psychology*. https://doi.org/10.1093/acrefore/9780190236557.013.3

Ehrhart, M. G., Schneider, B., & Macey, W. H. (2014). *Organizational climate and culture* (1st ed.) [E-book]. Routledge. https://doi.org/10.4324/9781315857664

Eisenbeiss, S. A., van Knippenberg, D., & Boerner, S. (2008). Transformational leadership and team innovation: Integrating team climate principles. *Journal of Applied Psychology*, *93*(6), 1438–1446. https://doi.org/10.1037/a0012716

Eunice, M. L., & Alencar, S. (2012). Creativity and organizations: facilitators and inhibitors. In M.D. Mumford (Ed.), *Handbook of Organizational Creativity* (pp. 359-386).

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007, May). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/bf03193146

Field, A. (2017). *Discovering statistics using IBM SPSS statistics: North American edition.* Sage Publications.

Fong, C. T. (2006). The effects of emotional ambivalence on creativity. *Academy of Management Journal, 49*(5), 1016–1030. https://doi.org/10.5465/AMJ.2006.22798182

Frazier, M. L., Fainshmidt, S., Klinger, R. L., Pezeshkan, A., & Vracheva, V. (2017). Psychological safety: A meta-analytic review and extension. *Personnel Psychology*, *70*(1), 113–165. https://doi.org/10.1111/peps.12183

Fridhandler, B. M. (1986). Conceptual note on state, trait, and the state–trait distinction. *Journal of Personality and Social Psychology*, *50*(1), 169–174. https://doi.org/10.1037/0022-3514.50.1.169

Frier, S. (2014, October 28). *Facebook $22 billion WhatsApp deal buys $10 million in sales*. Bloomberg.com. Retrieved September 5, 2022, from https://www.bloomberg.com/news/articles/2014-10-28/facebook-s-22-billion-whatsapp-deal-buys-10-million-in-sales

Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect the mediated effect. *Psychological Science*, *18*(3), 233–239. https://doi.org/10.1111/j.1467-9280.2007.01882.x

Fuller, J. B., Patterson, C. E. P., & Stringer, D. Y. (1996). A quantitative review of research on charismatic leadership. *Psychological Reports*, *78*(1), 271–287. https://doi.org/10.2466/pr0.1996.78.1.271

George, J. (1990). Personality, affect and behavior in groups. *Journal of Applied Psychology*, 75, 107-116. https://doi.org/10.1037/0021-9010.75.2.107

George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: An interactional approach. *Journal of Applied Psychology*, 86(3), 513–524. https://doi.org/10.1037/0021-9010.86.3.513

George, J. M., & Zhou, J. (2002). Understanding when bad moods foster creativity and good ones don't: The role of context and clarity of feelings. *Journal of Applied Psychology*, 87(4), 687–697. https://doi.org/10.1037/0021-9010.87.4.687

George, J. M., & Zhou, J. (2007). Dual tuning in a supportive context: Joint contributions of positive mood, negative mood, and supervisory behaviors to employee creativity. *Academy of Management Journal*, *50*(3), 605–622. https://doi.org/10.5465/amj.2007.25525934

Giner-Sorolla, R., Aberson, C. L., Bostyn, D. H., Carpenter, T., Conrique, B. G., Lewis, N. A. J., & Soderberg, C. (2019). Power to detect what? Considerations for planning and evaluating sample size. Retrieved from https://osf.io/jnmya/

Grant, A. M., & Berry, J. W. (2011). The necessity of others is the mother of invention: Intrinsic and prosocial motivations, perspective taking, and creativity. *Academy of Management Journal*, *54*(1), 73–96. https://doi.org/10.5465/amj.2011.59215085

Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. *Academy of Management Review*, *30*(2), 269–287. https://doi.org/10.5465/amr.2005.16387885

Hammond, M. M., Neff, N. L., Farr, J. L., Schwall, A. R., & Zhao, X. (2011). Predictors of individual-level innovation at work: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, *5*(1), 90–105. https://doi.org/10.1037/a0018556

Harrell, F. E. (2001). *Regression modeling strategies: With applications to linear models, logistic regression, and survival analysis*. Springer Science & Business Media.

Hathaway, S. R., & McKinley, J. C. (1943). *Manual for the Minnesota multiphasic personality inventory*. New York: Psychological Corporation.

Hayes, A. F. (2018). *Introduction to Mediation, moderation, and conditional process analysis: A regression-based approach (methodology in the social sciences)* (Second). The Guilford Press.

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. (Third). Guilford Publications.

Hayes, A. F., Montoya, A. K., & Rockwood, N. J. (2017, February). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling. *Australasian Marketing Journal*, *25*(1), 76–81. https://doi.org/10.1016/j.ausmj.2017.02.001

Hick, D. H., & Derksen, C. (2017). The problem of tragedy and the protective frame. *Emotion Review*, *9*(2), 140–145. https://doi.org/10.1177/1754073916639660

Hill, N. S., & Bartol, K. M. (2015). Empowering leadership and effective collaboration in geographically dispersed teams. *Personnel Psychology*, *69*(1), 159–198. https://doi.org/10.1111/peps.12108

Hittner, J. B. (2000). Novel methods for analyzing multifaceted personality scales: Sense of coherence and depression as an example. *The Journal of Psychology*, *134*(2), 199–209. https://doi.org/10.1080/00223980009600862

Huang, J. L., Curran, P. J., Keeney, J., Poposki, E. M., & DeShon, R. P. (2012). Detecting and deterring insufficient effort responding to surveys. *Journal of Business and Psychology*, *27*(1), 99–114. https://doi.org/10.1007/s10869-011-9231-8

Hughes, D. J., Lee, A., Tian, A. W., Newman, A., & Legood, A. (2018). Leadership, creativity, and innovation: A critical review and practical recommendations. *The Leadership Quarterly*, *29*(5), 549–569. https://doi.org/10.1016/j.leaqua.2018.03.001

Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology*, *94*(5), 1128–1145. https://doi.org/10.1037/a0015978

Hunter, S. T., Bedell, K. E., & Mumford, M. D. (2007). Climate for creativity: a quantitative review. *Creativity Research Journal*, *19*(1), 69–90. https://doi.org/10.1080/10400410709336883

Indranil, R., Hauptmann, M., & van Durme, Y. (2019, April 11). *Organizational performance: It's a team sport*. Deloitte Insights. Retrieved March 26, 2022, from https://www2.deloitte.com/us/en/insights/focus/human-capital-trends/2019/team-based-organization.html

Jackson, S. A. (2012). *The Oxford handbook of human motivation* (R. M. Ryan, Ed.; 1st ed.) (pp. 127-140). Oxford University Press.

Jobst, L. J., Bader, M., & Moshagen, M. (2021). A tutorial on assessing statistical power and determining sample size for structural equation models. *Psychological Methods.* Advance online publication. https://doi.org/10.1037/met0000423

Kass, G. V. (1980). An exploratory technique for investigating large quantities of categorical data. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, *29*(2), 119–127. https://doi.org/10.2307/2986296

Kiverstein, J., Miller, M., & Rietveld, E. (2020). How mood tunes prediction: A neurophenomenological account of mood and its disturbance in major depression. *Neuroscience of Consciousness*, *2020*(1). https://doi.org/10.1093/nc/niaa003

Klein, K. J., & Kozlowski, S. W. J. (2000). From micro to meso: Critical steps in conceptualizing and conducting multilevel research. *Organizational Research Methods*, *3*(3), 211–236. https://doi.org/10.1177/109442810033001

Kontoghiorghes, C. (2016). Linking high performance organizational culture and talent management: satisfaction/motivation and organizational commitment as mediators. *International Journal of Human Resource Management*, *27*(16), 1833–1853. https://doi.org/10.1080/09585192.2015.1075572

Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*(3), 77–124. https://doi.org/10.1111/j.1529-1006.2006.00030.x

Kozlowski, S. W. J., Watola, D. J., Jensen, J. M., Kim, B. H., & Botero, I. C. (2009). Developing adaptive teams: A theory of dynamic team leadership. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 113–155). Routledge/Taylor & Francis Group.

Latham, G. P., & Locke, E. A. (2018). Goal setting theory: Controversies and resolutions. In D. S. Ones, N. Anderson, C. Viswesvaran, & H. K. Sinangil (Eds.), *The SAGE handbook of industrial, work & organizational psychology: Organizational psychology* (pp. 145–166). Sage Reference.

Li, V., Mitchell, R., & Boyle, B. (2015). The divergent effects of transformational leadership on individual and team innovation. *Group & Organization Management*, *41*(1), 66–97. https://doi.org/10.1177/1059601115573792

Lindell, M. K., & Whitney, D. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology, 86*(1), 114–121. https://doi.org/10.1037/0021-9010.86.1.114

Locke, E. A., & Latham, G. P. (1990). A theory of goal setting & task performance. Prentice-Hall, Inc.

Locke, E. A., & Latham, G. P. (2002). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist*, *57*(9), 705–717. https://doi.org/10.1037/0003-066x.57.9.705

Lord, R. G., Day, D. A., Zaccaro, S. J., Avolio, B. J., & Eagly, A. H. (2017b). Leadership in applied psychology: Three waves of theory and research. *Journal of Applied Psychology, 102*(3), 434–451. https://doi.org/10.1037/apl0000089

Lorinkova, N., Pearsall, M., & Sims, H. P. (2013b). Examining the differential longitudinal performance of directive versus empowering leadership in teams. *Academy of Management Journal*, *56*(2), 573–596. https://doi.org/10.5465/amj.2011.0132

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99-128.

Malhotra, N. R. (2008). Completion time and response order effects in web surveys. *Public Opinion Quarterly*, *72*(5), 914–934. https://doi.org/10.1093/poq/nfn050

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review*, *26*(3), 356–376. https://doi.org/10.5465/amr.2001.4845785

Martin, R., Thomas, G., Legood, A., & Russo, S. D. (2018, February). Leader–member exchange (LMX) differentiation and work outcomes: Conceptual clarification and critical review. *Journal of Organizational Behavior*, *39*(2), 151–168. https://doi.org/10.1002/job.2202

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346

Mathieu, J. E., Gallagher, P. T., Domingo, M. A., & Klock, E. A. (2019a). Embracing complexity: Reviewing the past decade of team effectiveness research. *Annual Review of Organizational Psychology and Organizational Behavior*, *6*(1), 17–46. https://doi.org/10.1146/annurev-orgpsych-012218-015106

Mathieu, J. E., Hollenbeck, J. R., van Knippenberg, D., & Ilgen, D. R. (2017). A century of work teams in the Journal of Applied Psychology. *Journal of Applied Psychology*, *102*(3), 452–467. https://doi.org/10.1037/apl0000128

Mathieu, J. E., Luciano, M. M., D'Innocenzo, L., Klock, E. A., & LePine, J. A. (2019b). The development and construct validity of a team processes survey measure. *Organizational Research Methods*, *23*(3), 399–431. https://doi.org/10.1177/1094428119840801

McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*(1), 81–90. https://doi.org/10.1037/0022-3514.52.1.81

McDermott, M. R. (2001). Rebelliousness. In M. J. Apter (Ed.), *Motivational styles in everyday life: A guide to reversal theory* (pp. 167–185). American Psychological Association. https://doi.org/10.1037/10427-009

McKinsey. (2023, March 27). *What is agile?* https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-agile

McQuitty, S. (2004, February). Statistical power and structural equation models in business research. *Journal of Business Research*, *57*(2), 175–183. https://doi.org/10.1016/s0148-2963(01)00301-0

Meade, A. W., & Craig, S. B. (2012, April 16). *Identifying careless responses in survey data. psychological methods.* Advance online publication. doi: 10.1037/a0028085

Menard, S. (2009). *Logistic regression: From introductory to advanced concepts and applications.* Sage Publications. https://doi.org/10.4135/9781483348964

Miller, D., Okamoto, T., & Page, T. (2016, March 1). *Organizational design*. Deloitte Insights. Retrieved September 4, 2022, from https://www2.deloitte.com/us/en/insights/focus/human-capital-trends/2016/organizational-models-network-of-teams.html

Molleman, E. (2005). The multilevel nature of team-based work research. *Team Performance Management: An International Journal*, *11*(3/4), 113–124. https://doi.org/10.1108/13527590510606316

Monteiro, R. B., & Vieira, V. A. (2016). Team potency and its impact on performance via self-efficacy and adaptability. *BAR - Brazilian Administration Review*, *13*(1), 98–119. https://doi.org/10.1590/1807-7692bar2016150283

Morgeson, F. P., DeRue, D. S., & Karam, E. P. (2009). Leadership in teams: A functional approach to understanding leadership structures and processes. *Journal of Management*, *36*(1), 5–39. https://doi.org/10.1177/0149206309347376Z

Mumford, M. D., Scott, G., Gaddis, B., & Strange, J. M. (2002). Leading creative people: Orchestrating expertise and relationships. *Leadership Quarterly*, *13*(6), 705–750. https://doi.org/10.1016/s1048-9843(02)00158-3

Navas-Palencia, G. (2020). Optimal binning: mathematical programming formulation. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.2001.08025

Northouse, P. G. (2018). *Leadership: Theory and Practice*. Sage Publications, Inc.

Nunnally, J. C. (1978). An overview of psychological measurement. In *Springer eBooks* (pp. 97–146). https://doi.org/10.1007/978-1-4684-2490-4_4

Osborne, J., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. *Practical Assessment, Research & Evaluation, 8*(2), 1-9.

Palan, S., & Schitter, C. (2018). Prolific.ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance*, *17*, 22–27. https://doi.org/10.1016/j.jbef.2017.12.004

Paletz, S. B. F. (2012). Project management of innovative teams. In M.D. Mumford (Ed.), *Handbook of Organizational Creativity* (pp. 421-456). Elsevier.

Payne, R. (1990). Madness in our method. A comment on Jackofsky and Slocum's paper, 'A longitudinal study of climates.' *Journal of Organizational Behavior*, *11*(1), 77–80. https://doi.org/10.1002/job.4030110110

Peer, E., Brandimarte, L., Samat, S., & Acquisti, A. (2017, May). Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. *Journal of Experimental Social Psychology*, *70*, 153–163. https://doi.org/10.1016/j.jesp.2017.01.006

Peer, E., Rothschild, D., Gordon, A., Evernden, Z., & Damer, E. (2021, September 29). Data quality of platforms and panels for online behavioral research. *Behavior Research Methods*, *54*(4), 1643–1662. https://doi.org/10.3758/s13428-021-01694-3

Peer, E., Vosgerau, J., & Acquisti, A. (2014). Reputation as a sufficient condition for data quality on Amazon Mechanical Turk. *Behavior Research Methods*, *46*(4), 1023–1031. https://doi.org/10.3758/s13428-013-0434-y

Pituch, K. A., & Stevens, J. P. (2015). *Applied multivariate statistics for the social sciences* (6th ed.). Routledge Academic. https://doi.org/10.4324/9781315814919

Ployhart, R. E., & Bliese, P. D. (2006). Individual adaptability (I-ADAPT) theory: Conceptualizing the antecedents, consequences, and measurement of individual differences in adaptability, Shawn Burke, C., Pierce, L.G. and Salas, E. (Ed.) *Understanding Adaptability: A Prerequisite for Effective Performance within Complex Environments* (*Advances in Human Performance and Cognitive Engineering Research, Vol. 6*), Emerald Group Publishing Limited, Bingley, pp. 3-39. https://doi.org/10.1016/S1479-3601(05)06001-7

Porter, D. C., & Gujarati, D. N. (2008). *Basic Econometrics*. McGraw-Hill Education.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*(4), 717-731.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.

Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods*, *16*(2), 93–115. https://doi.org/10.1037/a0022658

Preacher, K. J., & Selig, J. P. (2012, April). Advantages of Monte Carlo confidence intervals for indirect effects. *Communication Methods and Measures*, *6*(2), 77–98. https://doi.org/10.1080/19312458.2012.679848

Rapp, T., Maynard, T., Domingo, M., & Klock, E. (2021). Team emergent states: What has emerged in the literature over 20 years. *Small Group Research*, *52*(1), 68–102. https://journals.sagepub.com/doi/pdf/10.1177/1046496420956715

Rigby, D., Sutherland, J., & Takeuchi, H. (2016, April 20). The secret history of agile innovation. *Harvard Business Review*. https://hbr.org/2016/04/the-secret-history-of-agile-innovation

Robson, R., & Carter, S. (2007). *The Apter leadership profiling system (ALPS): Internal consistency and prediction of employee engagement* [Presentation]. International Reversal Theory Conference, Wales, United Kingdom. https://reversaltheory.net/wp-content/uploads/2007-abstracts.pdf

Rothman, N. B., & Melwani, S. (2017). Feeling mixed, ambivalent, and in flux: The social functions of emotional complexity for leaders. *Academy of Management Review*, *42*(2), 259–282. https://doi.org/10.5465/amr.2014.0355

Rubin, M. (2017). Do *p* values lose their meaning in exploratory analyses? It depends how you define the familywise error rate. *Review of General Psychology, 21*, 269-275. doi: 10.1037/gpr0000123

Schaubroeck, J., Lam, S. S. K., & Peng, A. C. (2011). Cognition-based and affect-based trust as mediators of leader behavior influences on team performance. *Journal of Applied Psychology*, *96*(4), 863–871. https://doi.org/10.1037/a0022625

Schoemann, A. M., Boulton, A. J., & Short, S. D. (2017, May). Determining power and sample size for simple and complex mediation models. *Social Psychological and Personality Science*, *8*(4), 379–386. https://doi.org/10.1177/1948550617715068

Schwartz, J., Roy, I., Hauptmann, M., & van Durme, Y. (2019, April 11). *Organizational performance: It's a team sport*. Deloitte Insights. Retrieved September 4, 2022, from https://www2.deloitte.com/us/en/insights/focus/human-capital-trends/2019/team-based-organization.html.

Scott, S. G., & Bruce, R. A. (1994). Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace. *The Academy of Management Journal*, *37*(3), 580–607. https://doi.org/10.2307/256701

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Cengage Learning.

Shepherd, J. (2021). Flow and the dynamics of conscious thought. *Phenomenology and the Cognitive Sciences*. https://doi.org/10.1007/s11097-021-09762-x

Siangchokyoo, N., Klinger, R. L., & Campion, E. D. (2020). Follower transformation as the linchpin of transformational leadership theory: A systematic review and future research agenda. *The Leadership Quarterly*, *31*(1), 101341. https://doi.org/10.1016/j.leaqua.2019.101341

Siegall, M., & Gardner, S. (2000). Contextual factors of psychological empowerment. *Personnel Review*, *29*(6), 703–722. https://doi.org/10.1108/00483480010296474

Smith, K. C. P., & Apter, M. J. (1975). *A Theory of Psychological Reversals* (1st ed.). Picton Publishing.

Stollberger, J., West, M., & Sacramento, C. (2019). Innovation in Work Teams. In P. Paulus, & B. Nijstad (Eds.), *The Oxford Handbook of Group Creativity and Innovation* (2nd ed.). Oxford University Press.

Svebak, S., & Murgatroyd, S. (1985). Metamotivational dominance: A multimethod validation of reversal theory constructs. *Journal of Personality and Social Psychology*, *48*(1), 107–116. https://doi.org/10.1037/0022-3514.48.1.107

Thoemmes, F., MacKinnon, D., & Reiser, M. (2010). Power analysis for complex mediational designs using monte carlo methods. *Structural Equation Modeling: A Multidisciplinary Journal*, *17*(3), 510–534. https://doi.org/10.1080/10705511.2010.489379

Thomas, L. B., Hudson, J., & Oliver, E. J. (2018). Modeling motivational dynamics: demonstrating when, why, and how we self-regulate motivation. *Journal of Motivation, Emotion, and Personality: Reversal Theory Studies*, *7*(1). https://doi.org/10.12689/jmep.2018.704

U.S. Department of Labor. (n.d.). *Consolidated minimum wage table*. (n.d.). Retrieved October 31, 2022, from https://www.dol.gov/agencies/whd/mw-consolidated

Valentine, M. A., Nembhard, I. M., & Edmondson, A. C. (2015). Measuring teamwork in health care settings: A review of survey instruments. *Medical Care*, *53*(4), e16–e30. https://www.jstor.org/stable/26417947

van Knippenberg, D., & van Kleef, G. A. (2016). Leadership and affect: Moving the hearts and minds of followers. *Academy of Management Annals*, *10*(1), 799-840. https://doi.org/10.1080/19416520.2016.1160515

Van Veldhoven, Z., & Vanthienen, J. (2022). Digital transformation as an interaction-driven perspective between business, society, and technology. *Electronic Markets*, *32*(2), 629–644. https://doi.org/10.1007/s12525-021-00464-5

Vroom, V. H. (1964). *Work and motivation*. Wiley.

Walker, C. J. (2010). Experiencing flow: Is doing it together better than doing it alone? *The Journal of Positive Psychology*, *5*(1), 3–11. https://doi.org/10.1080/17439760903271116

Wang, J., Leung, K., & Zhou, F. (2014). A dispositional approach to psychological climate: Relationships between interpersonal harmony motives and psychological climate for communication safety. *Human Relations*, *67*, 489–515. http://dx.doi.org/10.1177/0018726713495423

Ward, M., & Meade, A. W. (2023). Dealing with careless responding in survey data: prevention, identification, and recommended best practices. *Annual Review of Psychology*, *74*(1), 577–596. https://doi.org/10.1146/annurev-psych-040422-045007

West, M. A. (1990). Innovation and creativity in work groups. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 63–80). John Wiley & Sons.

West, M. A., & Anderson, N. R. (1996). Innovation in top management teams. *Journal of Applied Psychology, 81*(6), 680–693. https://doi.org/10.1037/0021-9010.81.6.680

West, M. A., & Sacramento, C. A. (2012). Creativity and innovation: The role of team and organizational climate. In M.D. Mumford (Ed.), *Handbook of Organizational Creativity* (pp. 359-386).

Westfall, P. H., & Henning, K. S. S. (2013). *Texts in statistical science: Understanding advanced statistical methods.* Taylor & Francis.

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913-934.

Wright, J. (2016). Flow within everyday emotions and motivations: A reversal theory perspective. *Flow Experience: Empirical Research and Applications*, 197–212. https://doi.org/10.1007/978-3-319-28634-1_13

Xenikou, A., & Simosi, M. (2006). Organizational culture and transformational leadership as predictors of business unit performance. *Journal of Managerial Psychology*, *21*(6), 566–579. https://doi.org/10.1108/02683940610684409

Yentes, R. D. (2020). *In search of best practices for the identification and removal of careless responders.* PhD Thesis, N.C. State Univ., Raleigh

Yentes, R. D., & Wilhelm, F. (2021). *Careless: Procedures for computing indices of careless responding*. R package version 1.2.1.

APPENDIX A

HUMAN USE APPROVAL LETTER

LOUISIANA TECH UNIVERSITY

Office of Research and Partnerships

MEMORANDUM

TO PI (s): Dr. Mitzi Apter-Desselles and Matthew Johnson

FROM: Dr. Walter Buboltz, Professor/Elva L. Smith Endowed Professor
buboltz@latech.edu

SUBJECT: **Human Use Committee - Review DECISION**

DATE: February 17, 2023

In order to facilitate your project, an EXPEDITED REVIEW has been completed for your proposed study:

HUC No.: **IRB 23-164**

TITLE: **Team Member Study**

HUC DECISION: **APPROVED**

The proposed study's procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined. Projects should be renewed annually. ***This approval was finalized on February 17, 2023 and this project will need to receive a continuation review by the IRB if the project continues beyond February 17, 2024*** **ANY CHANGES** to your protocol procedures, including minor changes, should be reported immediately to the IRB for approval before implementation. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of Sponsored Projects.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Research and Partnerships or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

Thank you for submitting your Human Use Proposal to Louisiana Tech's Institutional Review Board.