2012

Facilitating Adaptive Team Performance: The Influence Of Membership Fluidity On Learning

Wendy L. Bedwell
University of Central Florida

FACILITATING ADAPTIVE TEAM PERFORMANCE:
THE INFLUENCE OF MEMBERSHIP FLUIDITY ON LEARNING

by

WENDY L. BEDWELL
M.D.E., University of Maryland, 2002
B.S., James Madison University, 1995

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Psychology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Summer Term
2012

Major Professor: Eduardo Salas

ABSTRACT

Organizations across work domains that utilize teams to achieve organizational outcomes experience change. Resources change. Project deadlines change. Personnel change. Within the scientific community, research has recently surged on the topic of team adaptation to address the issue of change specifically within teams. There have generally been two lines of research regarding team adaptation (task and membership). This effort is focused on membership. Teams are not static—members come and go. The membership adaptation literature has traditionally focused on the performance effects of newcomers to teams. Yet in practice, more and more teams today experience membership loss *without* replacement. Military units are stretched to capacity. Economic conditions have forced organizations to do more with less. When members leave, they are rarely, if ever, replaced. The very nature of some organizations lends itself to fluid team memberships. Consider an emergency room where a team of nurses and doctors work on Patient A. When a more critical Patient B arrives that requires the expertise of one of those team members, that doctor will leave the Patient A to tend to the Patient B. This practice is common in such work environments. Yet despite the prevalence of this practice, the scientific community knows very little about the impact of losing members on team performance. The current study examines the impact of membership fluidity on team performance. The purpose of this study was twofold. First, there was the need to address an empirical gap in the adaptation literature by focusing on membership changes (loss and loss with replacement) in non-creative tasks. Second was the consideration of the processes underlying adaptation—namely learning, operationalized as the development of effective shared mental models (SMMs). Thus, a primary goal was to determine the magnitude of team performance decrements associated with such changes within a decision-making task as well as the associated changes in team process. Results suggest that three-person intact teams demonstrated greater adaptive performance than membership loss with replacement teams. Furthermore, two-person intact teams developed more similar task and team interaction SMMs than membership loss teams when SMMs were indexed as a Euclidean distance score. There were no differences in the level of sharedness regarding task, team interaction or teammate SMMs for three-person intact teams as compared to membership loss with replacement teams. However, when teammate SMMs were operationalized as the personality facets (i.e., the Big 5) in exploratory analyses, three-person intact teams did develop more similar SMMs regarding the agreeableness facet than membership loss with replacement teams. Additionally, when operationalized as Euclidean distance, the agreeableness facet significantly predicted adaptive team performance—specifically, the smaller the distance (i.e., more similar the MMs), the greater the adaptive performance in teams. When operationalized as the similarity index, the neuroticism facet significantly predicted adaptive team performance such that the more similar the SMMs, the greater the adaptive performance in teams. Results suggest that membership fluidity does negatively influence the development of shared mental models among teammates. Furthermore, this study provides additional evidence that teammate and team interaction mental models, which are typically not examined together in team studies, are differentially influenced by membership fluidity and differentially predict outcomes like adaptive team performance. This suggests researchers should include both of these cognitive components of team performance to fully understand the nature of these constructs.

I dedicate this effort my daughter, Lyndsey Cierra Bedwell. My hope is that you take two things away from this. First, what your great-grandmother always said is indeed true: hard work and perseverance really do bring forth great rewards. Another important person in my life once told me that the greatest rewards are internal: a true sense of accomplishment and pride in yourself and your efforts—in spite of any obstacles (especially those self-imposed ones). So, enjoy your "gold star" moments, internalize them, and then move on to the next challenge! And second, I borrow from Steve Jobs, "Don't let the noise of others' opinions drown out your own inner voice…have the courage to follow your heart and intuition." To those wise words, I add only the following—at *any* age.

ACKNOWLEDGMENTS

Many, many people provided support and guidance along the way. First and foremost, to my family—your patience, generosity, support, and understanding throughout my graduate career enabled me to pursue my dream, successfully. To Jeff—your love and support are immeasurable. Thank you for constantly being father-of-the-year while I studied, traveled, worked late nights, worked weekends, etc. Without you, I could not have accomplished all that I have. To my sweet Lyndsey (my little boo!)—your cheerleading helped keep me going and your insights into team composition (i.e., "Mommy, just tell them you can't be mean and stay on a team!") were invaluable! To my parents and parents-in-laws—your help in the form of dinners/childcare and social support were/are amazing. I am so grateful as you all enabled me to work hard but still enjoy family time!

To Sallie & Julia—I am honored to call you colleagues, but most importantly, my dearest friends. Your late night texts, phone calls, and happy hours were a welcome source of inspiration & support. I am a better woman because of you both. Live, Laugh, Love!! To Dan—as you wish…"A little bit of data in my life. A little bit of coffee by my side. A little bit of syntax is what I need, A little bit of crazy's what I see. A little bit of me not in the sun. A little bit of analyses all night long. A little bit of regression in my talk. A little bit of writing makes me a doc!" Thanks for your friendship! To Jessie, Debbie, Mike R., Davin, Liz, Becki, Joe, Kyle, Amanda, Lauren and all of my past/present IST colleagues—your words of encouragement kept me going when things were difficult. Can't wait for conference reunions! To my NASA crew (Aaron, MJ, Becky, & James)—a big THANKS for the feedback & ideas that lead to this. To my RAs (especially Anthony, Jeremy, and Scott)—YOU ARE ROCK STARS! Your early mornings/late nights/weekends, & positive attitudes made this possible.

To my committee members—I send a *special* thank you. To Dr. Kim Smith-Jentsch—thank you for teaching me to develop my critical thinking skills and carefully consider my research designs.

I have learned much from you about what it means to be scientist-practitioner and I thank you for taking time to be my mentor, and my friend! To Dr. Florian Jentsch—thank you for sharing your analytical expertise and for being a sounding board at the office! Your passion for teaching complex topics is appreciated, very much admired, and something I hope to emulate in my own academic career. To Dr. Ramón Rico—thanks for the countless Skype hours you spent helping me personally and professionally. Working with you definitely shaped the course of this effort and I am grateful for your involvement. I look forward to future cross-cultural collaboration! And finally, to Dr. Steve Fiore—I am so grateful for your guidance and continuous encouragement, academically and personally. You have expanded my views on collaboration and what it means to be interdisciplinary.

To Dr. Barbara Fritzsche—my faculty and my friend! Thank you for introducing me to Ed (crazy, I know!). You saw something in me and knew I could excel with him. I am forever grateful. To Dr. Bob Pritchard—who knew all of this would come from one conversation on a dock many years ago? My gratitude & love. To Dr. John Mathieu, "my other mentor"—your guidance and friendship is so appreciated. One of the greatest gifts I received from Ed was an introduction to you.

And last, but certainly not least…To Dr. Eduardo Salas, my mentor, my colleague, my friend—how do I thank the man who undoubtedly changed the course of my life? You never, *ever* accepted anything but my best. You taught me to risk, to dream, and most importantly, to believe in myself. You opened doors, but made it clear I'd have to walk through alone. You pushed me when things were difficult. You challenged me. You frustrated me! And, I wouldn't change a thing, as I am who I am because of it all. A simple "thank you" seems woefully insufficient to capture all you have done to ignite my passion for my profession and propel me forward. Thus, I will instead say, "Stand by. There's much more to come." I know…I can *literally* hear you say, "Show me! Don't tell me!" Well that message is clear…in fact, it's *crystal* clear. *Pues, no te preocupes, jefe.* I intend to do just that. ☺

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

Statement of the Problem

"In the long history of humankind … those who learned to collaborate and improvise most effectively have prevailed" -- *Charles Darwin*

This quote by Charles Darwin suggests that working together and adaptation are critical skills for survival. Over four decades ago, Terreberry (1968) argued that adaptability would become a cornerstone for organizational success due to the changing nature of business, specifically theorizing that adaptive organizations would be the most sustainable organizations. The nature of work across domains today seems to support both Darwin's and Terreberry's claims. Certainly, collaboration is important as organizations across domains rely on teams to meet their goals and have thus, restructured work around the collaborative team unit (Ilgen, 1994). In the dynamic operational environment characteristic of medical, business, and military organizations, performance outcomes largely depend on the ability of these teams to quickly alter actions in response to rapidly changing internal or external contingencies that can substantially affect goal achievement (Kozlowski, Gully, Nason, & Smith, 1999). These characteristics (i.e., reliance on teams and dynamic nature of work) create a practical need to understand how teams adapt performance processes to achieve desired outcomes. In response, theoretical and empirical literature on team adaptation has steadily increased in recent years (Burke, Stagl, Salas, Pierce, & Kendall, 2006; Chen, 2005; LePine, 2003, 2005).

Team adaptation is defined as "a change in team performance, in response to a salient cue or cue stream, that leads to a functional outcome for the entire team," (Burke et al., 2006, p. 1190). The empirical literature has focused on two types of adaptability: task or membership change. Task changes in the literature tend to focus on reduction of resource availability (e.g., communication failure; LePine, 2005), whereas membership change research addresses issues related to team composition and/or configuration (e.g., removal of hierarchy; DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008). This effort is specifically focused on membership change.

Team Adaptation Approaches

Traditionally, there have been two approaches to studying team adaptation. One line has focused on identification of constructs relevant for selection of team members. For example, LePine (2003, 2005) found that cognitive ability, learning goal orientation, achievement, and openness to experience predicted adaptive performance. DeRue and colleagues (2008) considered various structural approaches to downsizing a team (i.e., membership change) and the personality factors that can mitigate negative effects of such disruption on performance. Results indicated that emotional stability and extraversion are key compositional variables in helping teams overcome the loss of a team leader, integration of a team leader into the team (i.e., removal of hierarchy), or loss of a team member while maintaining hierarchy.

Yet, selecting the composition of a team based on these characteristics is often impractical—or even impossible—in a real-world setting. Therefore, a second research stream has focused on validation of interventions designed to mitigate the negative effects that traditionally accompany task or membership changes. For example, Woolley (2009) argued that a process versus an outcome focus would differentially influence the ability of a team to adapt to task or membership changes. Although results did not support the process strategic focus hypothesis, an outcome strategic focus did improve adaptive performance in the task change condition. In another study investigating the effect of interventions, Rice and colleagues (2007) found that training formalized procedures and structured processes characteristic of long-duration virtual teams to virtual teams who would be working together for a much shorter duration significantly increased the adaptive effectiveness of these teams.

While this research is practically meaningful, the research community is still unclear as to *the processes* that enable adaptive behavior. Although much theory has sought to articulate these processes (e.g., Burke, Salas, Diaz Granados, Sessa, & London, 2008; Burke et al., 2006; Kozlowski et al., 1999), little empirical research has focused specifically on this aspect. There are some exceptions—for example, researchers have considered communication within teams who experienced task changes (e.g., Diedrich et al., 2003; Entin, Weil, See, & Serfaty, 2005). One seemingly critical process that has largely been ignored with regard to empirical work on adaptation, however, is learning. From a theoretical perspective, Burke and colleagues (2006) included learning as the final phase in their multiphasic model of team adaptation. In later work, they explicated the processes that underlie this learning (Burke et al., 2008). Both theoretically and empirically, Edmondson has moved the field forward with regard to conceptualizations of team learning (e.g., Edmondson, 1999; Edmondson, Dillon, & Roloff, 2007) and in one effort, considered learning in the context of adaptation to technology (Edmondson, Bohmer, & Pisano, 2001). However, little work has considered the implications of membership change on learning, particularly when operationalized as the development of cognitive processes such as effective mental models, or cognitive structures regarding a particular phenomenon.

Membership Loss

In addition to a lack of understanding with regard to the influence of membership change on team learning, the team adaptation literature is lacking in another important area. With the exception of initial work on team downsizing describe above, research on membership adaptation has largely focused on the impact of replacing a team member. Yet in practice, more and more teams today experience membership loss *without* replacement. Military units are stretched to capacity. Economic conditions have forced organizations to do more with less. When members leave, they are rarely, if ever, replaced. Without replacement, teams must rely on remaining member knowledge, skills, attitudes (KSAs), and other resources to adapt successfully. Despite the prevalence of this practice, the scientific community knows very little about the impact of losing members on team performance. For example, research has generally failed to consider the attributes of the "stayers" (Tannenbaum, Mathieu, Salas, & Cohen, 2012). To inform organizations how best to optimize the use of this human resource management (HRM) strategy—or even to provide initial scientific evidence regarding its effectiveness or ineffectiveness—research is required to investigate the impact of membership loss on team performance—specifically, loss without replacement.

Multilevel Theory

Finally, any discussion of team performance would be remiss without consideration of multilevel theory. There is a growing trend in the literature towards discussing emergence within teams (Kozlowski & Klein, 2000). Goldstein (2002) suggests that emergence within complex systems is characterized by the development of new, yet coherent, structures, properties, or patterns of behavior during a self-organization process. In essence, the whole (i.e., team) is greater than, or qualitatively different from, the sum of its component parts (Salas, Rosen, Burke, & Goodwin, 2009). Work focused on the adaptive capability of a team should be grounded in multilevel theory that considers the emergence of attitudes, behaviors, and cognitions from the individual level to the team.

Furthermore, a foundation of adaptive team performance is the degree to which teams learn (Burke et al., 2008). This learning can partially be seen through the development of team cognitions, including shared mental models (SMMs)—"common or overlapping cognitive representations of task requirements, procedures and role responsibilities," (Cannon-Bowers, Salas, & Converse, 1993, p. 222) and transactive memory systems (TMSs)—"the shared division of cognitive labor with respect to the encoding, storage, retrieval, and communication of information from different domains that often develops in close relationships" (Hollingshead, 2001, p. 1080). Essentially, SMMs emphasize common cognitions among team members whereas TMSs emphasize the unique and distinct cognitions among team members. The content of SMMs can focus on either task-relevant knowledge (i.e., taskwork) or team-relevant knowledge (i.e., teamwork). They emerge from individually held mental models up to the team level. TMSs also emerge from a complex combination of individually held knowledge to form a memory system that is larger and more complex than any individual component parts. TMS also refers to team and task knowledge, but again is focused on developing a metamemory of where specific expertise lies within the team. Thus, the content of a TMS is really the knowledge of who knows what on a team.

Learning about both the task and members of the team, operationalized as development of TMS and SMMs, should enable teams to adapt to dynamic conditions, including loss of members or integration of new members better than those teams who only learn about the task. Consider SMMs: research on pre-briefing and debriefing techniques organized around a model of teamwork have demonstrated that teams develop greater SMMs on teamwork through such structured discussions (Smith-Jentsch, Cannon-Bowers, Tannenbaum, & Salas, 2008). Although they did specifically not measure taskwork mental models, Smith-Jentsch and colleagues argue that development of those SMMs should also be strengthened through such discussions because taskwork issues naturally arise when organizing briefings and debriefings around teamwork, but teamwork issues do not naturally occur when only focusing on taskwork. Yet, to substantiate these claims on the benefits of learning with regard to adaption, lab studies aimed at investigating adaptation from a multilevel theoretical perspective regarding team cognitions are required.

Purpose of the Present Study

The purpose of this study was twofold. First, there is a need to address an empirical gap in the adaptation literature by focusing on membership changes (loss and loss with replacement) in non-creative tasks. Thus, a primary goal was to determine the magnitude of team performance decrements associated with such changes within a decision-making task that requires effective pooling of distinct knowledge. Additionally, it is critical to consider the processes underlying adaptation—namely learning, operationalized as the development of effective SMMs. Therefore, a secondary goal was to determine the degree to which SMMs influence adaptive performance within a decision-making task that requires pooling of member knowledge. By comparing a membership loss and a membership change condition to control groups of the same size, I was able to articulate not only the magnitude of performance decrements, but also determine whether different mental models (i.e., Task, Team Interaction, and Teammate SMMs—these will be more fully articulated in Chapter 2) are differentially influenced by various team configuration changes.

This study sought to provide empirical evidence regarding the validity of elements within two existing (and complementary) models of adaptive team performance (Burke et al., 2006; Kozlowski et al., 1999). Establishing validity naturally involves empirical testing of theory to identify inconsistencies and provide evidence for necessary theoretical refinements (Shadish, Cook, & Campbell, 2002). Additionally, this study is likely the first to investigate the relative influence of membership loss as compared to loss with replacement on team performance and appears to be the first to take a member from one existing team and replace a lost member of another existing team. This particular manipulation allowed for empirical investigation of fluid membership configurations, as called for by Tannenbaum and colleagues (2012).

CHAPTER TWO: LITERATURE REVIEW & HYPOTHESES

Membership Fluidity

Organizational demands require rapid reconfiguration of team members. This results in what has been labeled as "open groups" (Ziller, 1965) or more recently, "membership fluidity"(Tannenbaum et al., 2012). Membership fluidity describes the dynamic flow of members in and out of teams, resulting in a change to the team composition (Edmondson, 2003; Edmondson et al., 2001; Hirst, 2009; Tannenbaum et al., 2012; Ziller, 1965). This strategic HRM initiative can describe (1) integration of a new member into an existing team, (2) a change in membership where an existing member is lost and a new member joins, or (3) a loss of an existing member without replacement.

These three types of membership fluidity occur for several reasons. Consider membership gain. Managers may have formed a team that is too small to achieve their objectives. However, researchers suggest this is far less common than overstaffing teams (e.g., Hackman, 2002) and therefore, loss with replacement is generally more common. However, given the recent economic conditions affecting all work domains, membership loss is now the more prevalent human resource practice than loss with replacement. In consideration of those factors, this effort focuses on understanding the second and third types of membership fluidity: membership loss *with* and *without* replacement. I elaborate on these two types of membership fluidity below.

Membership Changes

Changes in membership of groups and/or teams occur for many reasons. Employees leave due to turnover, promotions, transfers, or changes in the scope of the project (Lewis, Belliveau, Herndon, & Keller, 2007). This often results in the integration of new members into a team to replace the lost member(s). Although there is not an abundance of research on membership change, much of the existing work has focused on the importance of socializing new members (see Moreland & Levine, 2001 for a comprehensive review).

However, most teams operating in any environment today experience membership loss without replacement. Economic conditions have forced organizations to do more with less. Layoffs became a common method for organizational survival during the early 2000s. During the recent economic recession in 2009, mass layoffs (i.e., at least 50 employees) increased dramatically (US Department of Labor Bureau of Labor Statistics., 2011). Although such large-scale layoff events have since decreased, the US Bureau of Labor Statistics (2011) announced that, as a result of these mass layoffs, 118,689 employees were let go in the month of October, 2011 alone.

Other work domains experience loss without replacement due to a limited number of potential replacement team members. Military units are stretched to capacity as most soldiers are currently deployed on either military operations or peacekeeping missions. If a member is lost or removed from a team, there are no replacement personnel available (Thompson & Duffy, 2003). Medical emergency room (ER) teams have limited staff on duty at any given time. When a critical patient arrives to the ER, on-duty physicians and/or nurses are pulled from a team working on a less critical patient to address the more serious needs of the new, more critical patient.

Results of research efforts focused on membership change suggest two schools of thought: the first argues for the benefits of membership change, in certain conditions. The second suggests that stable groups are preferable. Membership change, such as through job rotation, can increase the available knowledge stock (Kane, Argote, & Levine, 2005). Changes can also fuel reflection on the team's processes (Feldman, 1994; Sutton & Louis, 1987). By capitalizing on these benefits, teams may increase their flexibility and perform more effectively (Ancona, 1990; Gersick & Hackman, 1990; Waller, 1999).

On the other hand, when members leave, they take both tacit and explicit knowledge with them (Cascio, 1999), which has the negative effect of eliminate team access to that individually-held knowledge (Argote, 1999). Additionally, after membership change, attention is temporarily diverted from the task because teams are in a state of flux (i.e., dynamic, unstable pattern of interaction), which can result in process loss if not managed appropriately (Summers, 2009). Furthermore, familiarity that stems from membership stability (i.e., no change in membership) has been linked to greater cohesion, higher levels of coordination, lower levels of anxiety, increased willingness to express disagreement, and better performance (e.g., Gruenfeld, Mannix, Williams, & Neale, 1996; Kim, 1997; Levine & Moreland, 1991; Moreland, Argote, & Krishnan, 1998) as compared to those teams lacking in higher levels of familiarity. Such benefits of member familiarity have been demonstrated in field settings as well. For example, Smith-Jentsch and colleagues (2009) showed that air traffic control teams who were more familiar with one another both requested and accepted more backup than those teams comprised of members who were less familiar with one another. In another study on coal miners, Goodman and Leyden (1991) found that lower levels of familiarity were associated with lower productivity. Coupled with the findings from lab studies, this literature suggests that team stability is preferable to membership change. Below, I further explore these two schools of thought, specifically in relation to team performance.

Membership Change/Loss and Team Performance

There is limited empirical research on the effects of membership change in teams (Nemeth & Ormiston, 2007), particularly with regard to the influence of change on team processes and emergent states (i.e., attitudes, behaviors, and cognitions) that, in turn, influence team performance. See Table 1 for a review of empirical literature that targets membership change within teams as a manipulation. In the paragraphs that follow, I highlight relevant efforts—in which membership was specifically manipulated or the intended focus of the study—representing both schools of thought.

Table 1

Summary of Relevant Empirical Research on Membership Loss

Source	Nature of Membership Loss	Manipulation	Sample Description	Key Findings
Baer et al., 2010	"Open groups": departure of a member combined with the simultaneous arrival of a new member versus "Closed groups": remaining stable in the membership.	*Open Groups*: after first task, member of one team is switched with member of another team *Closed Group*: membership remained stable	280 undergraduate students at a large university (average age was 21years, 49 percent were men, and 75 percent were business majors) were assigned to 70 four-person groups (10 groups per experimental condition)	• Membership change moderates the quadratic effects of intergroup competition on group creativity in such a way that the effects describe an inverted U-shaped function in the case of closed groups but a U-shaped function in the case of open groups • Collaboration mediates the joint, quadratic effects of intergroup competition and membership change on creativity
Choi & Thompson, 2005	"Open groups": groups that experienced membership change over the course of a series of tasks versus "Closed groups": groups who did not experience membership change over tasks.	*Open Group:* Randomly replacing one of group members with a newcomer who had the same amount and type of task experience as the person he or she was replacing. *No Change*: membership remained stable	*Study 1*: 45 Master of Business Administration Students and 21 managers in an executive education course; assigned to 22 three-person groups (either closed or open group conditions); *Study 2*: 42 undergrads recruited via a campus ad, 30 undergrads enrolled in a 10-week psychology course, and 27 managers enrolled in an executive education course; assigned to 33 three-person groups (either closed or open group conditions)	• Membership change increased the number of ideas generated by groups (fluency) as well as the variance of these ideas(flexibility) • Membership change increased the creativity of oldtimers (i.e., stayers)

Source	Nature of Membership Loss	Manipulation	Sample Description	Key Findings
De La Hera & Rodriguez, 1999	"Stable teams": ones showing no membership loss versus "Membership loss teams": teams showing the loss of a member	*Change type 1*: compositionally stable teams throughout the eight weeks. *Change type 2*: teams with one member change in weeks 5, 6, 7 and 8 (thereby involving 100% of the members after the eight weeks). *Change type 3*: teams with a change of two members in weeks 5 and 7 (thereby involving 100% of the members after the eight weeks). *Change type 4*: teams with a change of one member in weeks 5 and 7 (thereby involving 50% of the members after the eight weeks). *Change type 5:* teams with a change of two members in week 7 (thereby involving 50% of the members after the eight weeks).	160 participants (133 were women and 27 were men; ages ranged from 20 to 34)	• Member change of greater magnitude → higher quality of productive results for teams performing this type of task as compared to compositional stability • Both greater and lesser member change magnitude → higher initial quantity and quality of productive results as compared to compositionally stable teams • Membership change → greater effectiveness, measured in terms of productive results, in the resolution of the tasks
DeRue et al., 2008	Structural approaches to team downsizing focusing on restructuring a team after removing a member	*Maintaining Hierarchy:* removing a member but maintaining the existing hierarchy *Eliminating Hierarchy*: removing the leader *Integrating Hierarchy*: removing a member and integrating the leader into the team by eliminating the hierarchy *No Change*: membership remained stable	355 upper-level undergraduate students from a large Midwestern university, average age = 21 yrs., 57% male	• Teams in the maintaining and integrating performed significantly worse than teams who did not experience downsizing • Teams in the eliminating hierarchy condition did not significantly differ from control teams; thus, they performed significantly better than teams in both the maintaining and integrating hierarchy conditions • Control teams engaged in significantly more quantitative adaptive behaviors (i.e., total number of times teams launched assets and correctly identified friendly or

Source	Nature of Membership Loss	Manipulation	Sample Description	Key Findings
				enemy targets) than any of the membership loss teams • Control teams engaged in significantly more qualitative adaptive behaviors (i.e., total number of times members provided back-up) than either maintaining or integrating hierarchy teams
Levine & Choi, 2004	"Replacement": group's commander or specialist was replaced versus "No replacement": the group remained intact	*Member Replacement*: Replacing the specialist with a specialist from another team *Leader Replacement:* Replacing the commander with a commander from another team *No Change:* Leaving the team's composition intact	90 male undergraduate students randomly assigned to three-person teams (composed of two specialists and a Commander)	• Newcomer ability and newcomer status made a difference in how teams adapted to personnel change • Team performance and personnel turnover influenced strategy-relevant communication among team members • Team performance influenced motivational communication among members • Motivational communication was positively correlated with team performance
Lewis et al., 2007	"No membership change": group membership remains stable versus "Partial membership change": a few members are replaced within the group versus "Complete membership	*Intact*: composed of three members originally trained in the same group *Partially-intact*: composed of two members who were trained together and one who trained in another group *Reconstituted*: composed of three members, each of whom had been trained in a different group) to perform the task.	90 three-person groups (270 participants) completed the entire study (13 all-male groups, 16 all female groups, 33 groups with two males and one female, and 28 groups with two females and one male)	• The stability of the TMS structure in partially-intact groups are comparable to that in intact groups and greater than that in reconstituted groups, whose TMS structure was presumably destabilized when members were reassigned to new groups • Newcomers to partially intact groups are more likely than oldtimers to adapt their specializations to maintain stability in the group's expertise structure

Source	Nature of Membership Loss	Manipulation	Sample Description	Key Findings
	change": all members in the group are replaced			• TMS processes in partially-intact groups are relatively inefficient, comparable to the TMS processes of reconstituted groups and significantly less efficient than intact groups • Differences between membership change conditions with respect to group performance are explained by differences in TMS process efficiency
Nemeth & Ormiston, 2007	"Same membership": having the same people in a group throughout the tasks versus "Complete change": all members in a group are changed	*Change*: Participants moved to a completely new group to brainstorm on a second, unrelated issue *No Change:* Participants stayed with the same group after the first task	164 participants comprising 41 groups of four persons	• Stable membership groups experienced higher levels of comfort and perceived friendliness than membership change groups • Stable membership groups perceived their groups to be more creative; however, actual creativity showed a reverse pattern, whether defined as number of ideas generated, idea creativity or the divergent thought manifested by those ideas
Prislin & Christensen, 2005	"Initial majority position": established by two of the three confederates agreeing with the participant on the first five issues versus "Initial minority position": established by all three confederates disagreeing with	*Complete Change:* two confederates reversed their patterns of responses, one beginning on the 6th and one on the 11th issue *Partial Change:* one confederate reversed his or her pattern of responses beginning on the 6th issue *No Change:* all three confederates maintained their patterns of responses, thereby making the participant's initial position stable	*Study 1*: 220 undergrads (130 were women and 82 were men) *Study 2*: 174 undergrads (108 were women and 54 were men)	• Following change, members of both factions show little preference to remain with their current group and were likely to seek an alternative group membership, especially when no apparent costs associated with a group change • Prolonged experience in the acquired majority position associated with slowly improved perceptions of the group among the former minority

Source	Nature of Membership Loss	Manipulation	Sample Description	Key Findings
	the participant on the first five issues			
Summers, 2009	"Newcomers": someone new joining the team versus "Leavers": someone leaves the team	*Controllability manipulation*: departing members were allowed to share relevant information regarding the knowledge and responsibilities for their particular role within the team *Uncontrollable manipulations*: no information was allowed to be passed *Predictability manipulation*: members were informed that a member from their team would be leaving, and would be replaced with another member *Unpredictable manipulation*: nothing was said to tip off the team off that member change would be coming	*Study 1*: 432 upper-level undergrads (108 four-person teams) *Study 2*: 25 upper-level undergrads	• High levels of member change controllability → low levels of flux in coordination • High levels of member change predictability → low levels of flux in coordination • The relationship between controllability and the flux in coordination caused by member change is moderated by role criticality such that when team member attributions for member change are uncontrollable, role criticality increases the level of flux in coordination; however, flux is not impacted by role criticality when the attribution is controllable • Flux in coordination mediates the relationship between attributions for member change and change task performance following member change
Woolley, 2009	"Membership change": change in a member or members of the group versus "Loss of materials": critical building materials were removed from the group	*Controlled condition*: no membership change or loss of materials *Membership change*: change in a member or members of the group *Loss of materials*: critical building materials were removed from the group	90, 3-person teams composed of male and female undergraduates who were randomly assigned to groups	• Group norms maintained the team's focus • Process focus did not improve a team's ability to deal with member change • The way a team conducts its initial interaction can establish important and lasting norms about how they will function as a team

1st School of Thought: Change Benefits Teams. The majority of research supporting the first school of thought (i.e., change benefits teams) has considered the impact of membership change within *creative tasks*. Newcomers who recently joined the team as a result of membership change have been found to increase the number of ideas generated, the variance of these ideas, and the creativity of "oldtimers" (i.e., those members who remain in a team Choi & Thompson, 2005). Similar results were found by Baer and colleagues (2010) in collaborative or highly competitive teams who experienced membership change as both types outperformed those teams with stable membership in an idea generation task.

De La Hera and Rodriguez (1999) also found that teams who experienced membership change generated higher quality alternatives in problem-solving tasks as compared to those with stable membership and the greater the magnitude of membership change, the better. Although stable membership teams *perceived* themselves to be more creative, teams with membership change actually were more creative in terms of the number of ideas generated, the creativity of those ideas, and the divergent thoughts manifested from those initial ideas (Nemeth & Ormiston, 2007). In integrating this research, the overarching theme is membership change can be beneficial when teams are working on *creative tasks*.

2nd School of Thought: Change Harms Teams. Considering those in support of the stable membership school of thought, much of the early research targeted managerial turnover (e.g., Guest, 1962; Smith & Nyman, 1939) and focused on tasks that were not based on creativity. For example, in sports teams, researchers found that managerial turnover (Grusky, 1963) as well as coaching changes during a season (Eitzen & Yetman, 1972) negatively influenced team performance. More recently, findings further support this negative influence of membership change on team performance. DeRue and colleagues (2008) found that control teams (i.e., no membership change) performed significantly better on a military command-and-control simulation (i.e., decision making tasks) than teams who lost a member, regardless of whether they maintained hierarchy (i.e., kept the leader in the formal leader role within the team) or integrated the leader (i.e., leader hierarchy was removed and leader became "part of the team"). Furthermore, control teams engaged in significantly more quantitative adaptive behaviors (i.e., total number of times teams launched assets and correctly identified friendly or enemy targets) than teams that lost a member.

Other literature focuses on the more proximal beneficial influence of stability on team processes, which ultimately enables effective performance in tasks that do not rest on creativity (such as idea generation) for achievement of desired performance outcomes. Specifically, membership stability leads to familiarity, which enables members to (1) develop a shared understanding of how members prefer to work as well as the knowledge and task processes required for success (i.e., SMMs), and (2) leverage that knowledge to effectively coordinate activities and improve performance (Moreland, 1999; Smith-Jentsch et al., 2009). Indeed, Lewis and colleagues (2007) when studying a production-type task (i.e., assembling a telephone) found differences in the stability of TMS structure (i.e., the shared understanding of who knows what on a team) between intact teams of three members who were originally trained in the same group and reconstituted teams of three members who were all trained in different groups. Furthermore, TMS processes (i.e., transactive processes that enable groups to continue to encode, store and retrieve information—thereby updating the structure) in partially-intact teams of three members (two of whom were originally trained together and one who was trained in another group) were significantly less efficient as compared to intact teams who did not experience any membership loss. These inefficiencies in the TMS processes accounted for the lower performance levels in groups experiencing membership change.

Taken together, these examples provide evidence that in non-creative tasks, membership change *does not improve* team performance. Instead, changes in membership leads to performance decrements by negatively affecting such processes and emergent states as team cognitions, which have been demonstrated as critical for effective team performance (see Mathieu, Maynard, Rapp, & Gilson, 2008 for a more detailed review of the literature supporting the relationships between these team cognitions—SMM and TMS—and team performance). The task used in the present study does not rest of the generation of creative ideas, but rather the use of existing, distributed information to make informed decisions. As such, it is expected that the decrements to performance stemming from membership change previously identified with other non-creative types of tasks (consistent with the second school of thought) will be replicated in this study. Therefore, I predict the following:

H1a: *Two-person intact teams will demonstrate greater adaptive performance than will two-person membership loss teams.*

H1b: *Three-person intact teams will demonstrate greater adaptive performance than will three-person membership loss with replacement teams.*

Adaptive Performance

Performance, at both the individual and team level, is not simply the result of processes, but rather the actions required to enact those processes (Campbell, 1990; Edmondson et al., 2007). Researchers have applied this argument to the concept of adaptive team performance (Burke et al., 2006; Kozlowski et al., 1999), suggesting it is "an emergent phenomenon that compiles over time from the unfolding of a recursive cycle whereby one or more team members use their resources to functionally change current cognitive or behavioral goal-directed actions or structures to meet expected or unexpected demands" (Burke et al., 2006, p. 1192). It is inherently multilevel as these behavioral and/or cognitive changes emanate from the individual members of the team. Yet, a focus solely on the individual contributions limits understanding of team constructs (Kozlowski & Klein, 2000). Thus, adaptive team performance is conceptualized as a configural construct—a continuously evolving compilation of bottom-up processes across levels and times (Kozlowski et al., 1999).

This is not to argue that team performance is simply the sum of similar individual efforts and operationalized as the mean of individual-level performance. Indeed team performance is emergent in nature, and can be operationalized along a continuum of the mean of similar individual-level contributions to the more complex patterns of different types and amounts of individual-, dyadic-, and team-level contributions (Kozlowski & Klein, 2000). The distinction between team performance and *adaptive* team performance lies in (1) the detection and framing of a cue (or set of cues) that signal the need for altering action, and (2) the functional change that ensues as a result of cue(s) identification (Burke et al., 2006). Essentially, adaptive team performance reflects shifts in the pattern of contributions and, thus, emerges because of the dynamic and recursive cycle of cognitive, affective, and behavioral actions of team members.

Adaptive team performance is not synonymous with team adaptation. Team adaptation is an outcome of cue identification. It is the actual change in process that a team enacted based on the identification of a relevant cue (Burke et al., 2006). Thus, the focus of this effort is on adaptive performance, as teams must change their processes (i.e., engage in team adaptation) in order to achieve desired goals in the face of change (i.e., successful adaptive team performance).

Learning

Team learning in this study is defined according to the definition outlined by van Offenbeek (2001), which is derived from the work of Huber (1991). Team learning is "an iterative team process in which information is (1) acquired, (2) distributed, (3) interpreted both convergently and divergently, and (4) stored and retrieved leading to a change in the range of a team's potential behaviours" (van Offenbeek, 2001, p. 305). This definition allows for incorporation of a number of learning behaviors outlined within previous conceptualizations of team learning, such as those by Edmondson (1999), who argues that sharing information, talking about errors, asking for help, seeking feedback, and experimenting are examples of team learning behaviors. Others have considered the development of collective cognition as consisting of similar processes. Collective cognition has been defined as "the group processes involved in the acquisition, storage, transmission, manipulation, and use of information" (Gibson, 2001, p. 123).

In this particular effort, sharing of information is argued as a critical behavior, which is required for learning. In ad hoc teams performing in temporally bounded dynamic settings, teams need to rapidly engage in information sharing as the situation can change at any time and, in such contexts, researchers advocate the importance of learning for successful team adaption (Burke et al., 2006; Kozlowski et al., 1999). Drawing on the work of Edmondson, Burke and colleagues argue that the development of knowledge allows teams to identify changes that require teams to adapt performance processes more effectively. Similarly, in the Kozlowski and colleague model, the authors compare the team adaptation process with that of a novice transition to an expert. In essence, the entire process is predicated on effective learning of content—both knowledge and skills—that enables adaptation. In team contexts, this requires exchanging of information to aid development of one particular type of cognition, shared mental models.

Shared Mental Models. Mental models are "organized knowledge structures … [that] enable people to describe, explain, and predict events in their environment" (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000, p. 274). SMMs, therefore, are organized knowledge structures that are *shared* among team members. Sharing information among team members results in development of shared mental models. Researchers argue that shared mental models enable teams to perform in dynamic conditions (Cannon-Bowers et al., 1993). Cannon-Bowers and colleagues (1993) have argued for the existence of several types of SMM when teams are engaged in complex tasks. They specifically addressed four types. Team members must have a shared understanding of the *technology/equipment* required for task completion. Members must also share knowledge structures regarding the *task*, specifically procedures, task strategies, constraints and resources. Third, teams share knowledge regarding *team interaction*, which is comprised of the roles/responsibilities, interaction patterns, interdependencies, and information flow. Finally, teams can have shared knowledge regarding *teammates*, such as knowing other members' skills, attitudes, preferences and tendencies. This includes knowing about member personality factors which can influence behavior (e.g., the Big 5 personality factors).

Mathieu and colleagues (2000) considered the difficulty in operationalizing these four types within a single study. Ultimately, they suggested that all four types essentially depict two major content domains: team relevant information and task relevant information. Arguably, collapsing the Task SMMs does make sense in this effort as it is difficult to separate the components of those two dimensions (e.g., there is no specialized equipment therefore knowing the operating procedures naturally involve knowing the task procedures). However, maintaining distinction among the Team Interaction and Teammate SMMs is important in this particular study, as members can have a shared understanding of the roles/responsibilities and interaction patterns (i.e., Team Interaction SMMs) without having a shared understanding of members preferences (i.e., Teammate SMMs). Therefore, I distinguish among—and measure—three types of SMMs: Task knowledge, Team Interaction knowledge, and Teammate knowledge, as depicted in Table 2 below.

Table 2

Types of Shared Mental Models in Teams & Example Knowledge

Original Cannon-Bowers et al. Taxonomy Type	Relevant Knowledge Within Each Type
	Task SMM
Technology/Equipment	• Equipment functioning • Operating procedures • System limitations
Job/Task	• Task procedures • Task strategies • Task component relationships • Resources
	Team Interaction SMM
Team Interaction	• Roles/responsibilities • Interaction patterns • Role interdependencies • Information flow
	Teammate SMM
Team	• Teammates' knowledge • Teammates' skills • Teammates' attitudes • Teammates' preferences • Teammates' tendencies

Note. Adapted from "Shared mental models in expert team decision making," by J. A. Cannon-Bowers, E. Salas, and S. A. Converse (1993), in *Individual and group decision making,* by N. J. Castellan, Jr. (Ed.), Hillsdale, NJ: Erlhaum.

Research has firmly established a positive relationship between SMMs and team performance (DeChurch & Mesmer-Magnus, 2010a, 2010b) Additionally, both task SMM (e.g., Cooke, Kiekel, & Helm, 2001; Lim & Klein, 2006) and team SMM (Mathieu et al., 2000; Rentsch & Klimoski, 2001) enable effective team performance. Research has generally found that task SMMs exert stronger direct effects on team performance than team SMMs (Cooke et al., 2001; Cooke et al., 2003; Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). However, in a study of undergraduate dyads in a flight simulation task, Mathieu and colleagues (2000) found that team

SMMs directly influenced performance whereas task SMMs only showed indirect effects on team performance through team processes.

Further complicating the relationships between team and task SMMs and team performance, Smith-Jentsch and colleagues (2005) demonstrated no main effects of either type in a field study of air traffic controllers, but rather a significant interaction between task (operationalized as cue-strategy associations) and team (operationalized as positional goal interdependencies) SMMs that predicted both safety and efficiency. More specifically, when task SMMs were highly shared, team interaction SMMs were positively related to safety and efficiency; however, when task SMMs were not highly shared, team interaction SMMs were negatively related to these outcomes. Similar results were evidenced by Mathieu and colleagues (2009), who also studied air traffic controllers and found that task SMMs were more strongly related to team effectiveness when teams had high team interaction SMMs.

Importantly, research has suggested two approaches to studying SMMs—focusing on the level of similarity among members (i.e., sharedness) or the degree to which the team mental models reflect an expert model (i.e., quality or accuracy). Research suggests that the degree to which team MMs (generally operationalized as team interaction SMMs) are accurate as compared to an expert model is more predictive of team performance than similarity measures of MMs (B. D. Edwards, Day, Arthur, & Bell, 2006). Others have found that the interaction of these two types of mental model measures exert positive influence over team processes and team performance (Marks, Zaccaro, & Mathieu, 2000; Mathieu et al., 2005). Although prior research is helpful in determining which particular mental model metric to use, the task often dictates which one is most appropriate. The task used in this study (described more fully in Chapter 3) was a customer service task. Tasks were divided among roles, which were assigned to participants. There was no one correct way to go about each job. Therefore, in this study, interest lied in the degree to which members *shared* knowledge.

Little research has specifically considered the influence of membership change on the development of SMMs or the influence of SMMs on adaptive performance. With regard to the relationship between membership change and team performance, research has considered team tenure as contributing to the development of SMMs. Navy personnel with greater tenure in the service had more similar *Teammate* SMMs than those with less tenure (Smith-Jentsch, Campbell, Milanovich, & Reynolds, 2001). In considering adaptive performance, Marks and colleagues (2000) found that leader briefings and team-interaction training influenced development of *Team Interaction* SMMs, which lead to better team communication processes and performance. Furthermore, these *Team Interaction* SMMs were stronger predictors of performance in novel as compared to routine environments. Chen and colleagues (2005) considered the relationship of "team knowledge" (operationalized as an aggregation of the degree to which members understand their individual roles – which is indicative of *Team Interaction* SMMs) to adaptive performance. Although a slightly different construct from Team Interaction SMMs as it is not reflective of the sharedness of this knowledge, this aggregated team knowledge was found to predict adaptive performance. Finally, Waller and colleagues (2004) looked at adaptive performance in the field with nuclear power control room crews and found that during non-routine situations, higher performing teams engaged in more *Task* SMM development than lower performing teams.

The second, third, and fourth set of hypotheses focus on SMMs as a possible mechanism by which membership fluidity is related to adaptive performance. As noted above and consistent with team adaptation theory (e.g., Burke et al., 2006), it is suggested that this relationship is partially mediated by each of the types of SMMs described above (i.e., task, team interaction, and teammate).

This notion is supported not only by literature (e.g., Marks et al., 2000; Waller et al., 2004), but also by early theory on SMMs. Cannon-Bowers and colleagues (1993) argued that SMMs enable teams to more effectively coordinate actions and adapt behavior to task demands, which leads to greater performance. However, it is further suggested that membership fluidity will differentially influence the various mental models, and thus, specific contrasts regarding SMM development among intact teams and teams who experience membership fluidity are articulated below.

According to the taxonomy presented above (Cannon-Bowers et al., 1993), Task SMMs are comprised of such task-relevant knowledge as task procedures, task strategies, resources, and operating procedures. When teams experience membership change (i.e., losing a member who is then immediately replaced by another member who has been working on a similar task), this type of shared knowledge could potentially remain highly shared when such information is completely standardized. However, even in the most standardized tasks, teams still have the ability to determine their own task strategies. In membership change teams, the lost member is being replaced with another member who likely had different task experiences based on his/her previous team. With regard to membership loss, teams will need to reconfigure rapidly, which would necessitate a change in task strategies. As compared to intact teams of the same size who do not experience these changes, teams with fluid membership will not have as highly shared Task MMs. Therefore, I suggest:

H2a: *Two-person intact teams will develop more similar Task MMs than two-person membership loss teams.*

H2b: *Three-person intact teams will develop more similar Task MMs than three-person membership loss with replacement teams.*

Given the positive relationship among SMMs and performance in teams (DeChurch & Mesmer-Magnus, 2010), it is suggested that these same findings will extend to adaptive performance as well. Indeed, the Waller and colleagues (2004) study on Task SMMs and adaptive performance in nuclear power plant control room crews suggests that Task SMMs aid adaptive performance in novel environments. Essentially, I am, therefore, arguing that Task SMMs partially mediates the relationship between membership fluidity and adaptive team performance. Therefore, I hypothesize:

> ***H2c:*** *Task MMs similarity will be positively related to adaptive performance.*

> ***H2d:*** *Task SMMs will partially mediate the relationship between membership fluidity and adaptive team performance.*

Recall that Team Interaction SMMs are comprised of several types of team relevant knowledge such as individual roles/responsibilities; the interaction patterns established by the team for effectiveness; role interdependencies; and the flow of information. This knowledge is independent of who is on the team (i.e., team generic). Teams who experience stability or change will have no disruptions (or little disruption) to the development of such member generic Team Interaction SMMs because the roles/responsibilities and interdependencies were clearly articulated during training. These teams should, therefore, realize the adaptive performance benefits demonstrated in the literature regarding Team Interaction SMMs. However, teams that experience loss must reconfigure the roles/responsibilities and interdependencies among remaining members. These teams will experience the greatest disruption in components that comprise Team Interaction SMMs. Therefore, I suggest:

> ***H3a:*** *Two-person intact teams will develop more similar Team Interaction MMs than two-person membership loss teams.*

Just as Task SMMs are important for team performance, it is suggested that this type of SMM will also be positively related to adaptive performance. Marks and colleagues (2000) found that Team Interaction SMMs were stronger predictors of performance in novel as compared to routine environments. Chen and colleagues (2005) considered the relationship of "team knowledge" (operationalized as an aggregation of the degree to which members understand their individual roles – which is indicative of Team Interaction SMMs) to adaptive performance. Although a slightly different construct from Team Interaction SMMs as it is not reflective of the sharedness of this knowledge, this aggregated team knowledge was found to predict adaptive performance. In light of these findings, I argue similar effects will be found in this study and thus, again predict mediation:

***H3b**:* *Team Interaction MMs similarity will be positively related to adaptive performance.*

***H3c**:* *Team Interaction SMMs will partially mediate the impact of membership loss and adaptive team performance for two-person teams.*

Finally, when considering Teammate SMMs, the content is team specific in that the tendencies of members to operate in a particular fashion are based on member personalities. In both intact and membership loss teams, the *content* of the team-specific knowledge within the Teammate SMM does not dramatically change. In other words, remaining team members should still have a shared understanding of each other's preferences, knowledge, attitudes, etc. based on their individual assessments of each other's personalities, gained through observation while working together. However, membership change teams must integrate a new member whose preferences, tendencies, etc. are unknown. When new members join teams, there has been no opportunity to observe them working and, therefore, no opportunity to pick up on cues regarding their personality. When compared to intact teams, membership change teams will not have the same degree of sharedness with regard to Teammate MMs, when operationalized as personality assessments, as these teams will have to learn about a new member in a relatively short period of time. In fact, prior research has found that team tenure contributes to the development of *Teammate* SMMs (Smith-Jentsch, Kraiger, Cannon-Bowers, & Salas, 2009). Therefore, I argue:

***H4a**:* *Three-person intact teams will develop more similar Teammate MMs than three-person membership loss with replacement teams.*

Just as Task and Team Interaction SMMs are important for team performance, it is anticipated that this Teammate SMMs will also be positively related to adaptive performance. Knowing how other team members tend to operate enables teams to anticipate the actions of their teammates and respond effectively (Cannon-Bowers et al., 1993; Rouse, Cannon-Bowers, & Salas, 1992; Smith-Jentsch et al., 2001). Based on these findings, I again argue for partial mediation between membership fluidity and adaptive team performance.

***H4b**:* *Teammate MM similarity will be positively related to adaptive performance.*

***H4c**:* *Teammate SMMs will partially mediate the impact of membership replacement and adaptive team performance for three-person teams.*

Although there are arguably direct effects of membership configurations on the development of SMMs as articulated above, much of this learning can occur through transition processes, operationalized in this study as the amount of information sharing that teams engaged in. Consider Task SMMs. Even though removing a member does not change the *type* of task knowledge that needs to be shared (e.g., Task SMMs require sharing of task strategies and procedures), the new member may have a different conceptualization of this task relevant knowledge as described previously. If those differences are not uncovered through information sharing during planning periods, membership change teams will have lower levels of Task SMMs as compared to three-person intact teams and thus, will not realize the adaptive performance benefits of developing high levels of Task SMMs.

With regard to membership loss, as mentioned previously, teams will need to reconfigure rapidly, which would necessitate a change in task strategies. If the remaining members do not clearly articulate their thoughts regarding how task strategies should change, these teams will not have as high a level of shared Task MMs as intact teams. In this sense, these transition processes (i.e., information sharing) should moderate the relationship between membership fluidity and learning (operationalized as Task SMMs). If teams share critical information during transition periods (i.e., planning periods), they will develop more highly shared mental models. This sharing is even more critical to teams who experience membership loss or membership loss with replacement, as they will not have other opportunities to develop SMMs. More formally, I hypothesize:

> ***H5a**: Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.*

> ***H5b**: Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.*

Similar to Task SMMs, this information sharing (i.e., transition process) moderates the relationship between membership fluidity and learning, operationalized as Team Interaction SMMs. If, membership loss teams do not engage in high levels of information sharing, members will not develop the same level of shared Team Interaction MMs as their intact counterparts who have had more time to engage in such sharing throughout the duration of the task. However, if they are able to share information regarding the change in roles that is required by losing am member, teammates will have more similar understandings of how the team should coordinate roles and move forward in the next action phase—all of which comprise Team Interaction SMMs. Thus, I predict:

> ***H6**: Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Team Interaction SMMs. The differences in Team Interaction MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.*

Finally, when considering Teammate SMMs, as noted above, membership change teams must integrate a new member whose preferences, tendencies, etc. are unknown. When compared to intact teams, membership change teams who do not share information during the transition periods (i.e., planning periods) will not develop as strong a Teammate SMM as they would if they do share. By sharing information, teams can begin to gauge each other's personality characteristics. For example, if members focus on specific details, it provides insight into levels of conscientiousness. The willingness to engage in a task after a disruptive change can provide insights into agreeableness. Therefore, I argue:

> ***H7***: *Transition processes, operationalized as information sharing will moderate the relationship between membership fluidity and Teammate SMMs. The differences in Teammate MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.*

In summary (see *Figure 1*), it is predicted that the development of effective shared mental models will mitigate the negative influence of membership change or membership loss on team performance. This occurs through a complex process that involves information sharing, which influences the degree to which teams develop shared mental models. Team learning (development of effective SMMs) enables team performance and thus, can improve performance for teams who do not experience membership change and mitigate the negative influence of membership loss with replacement or membership loss on performance. *Table 3* summarizes the hypothesized relationships.

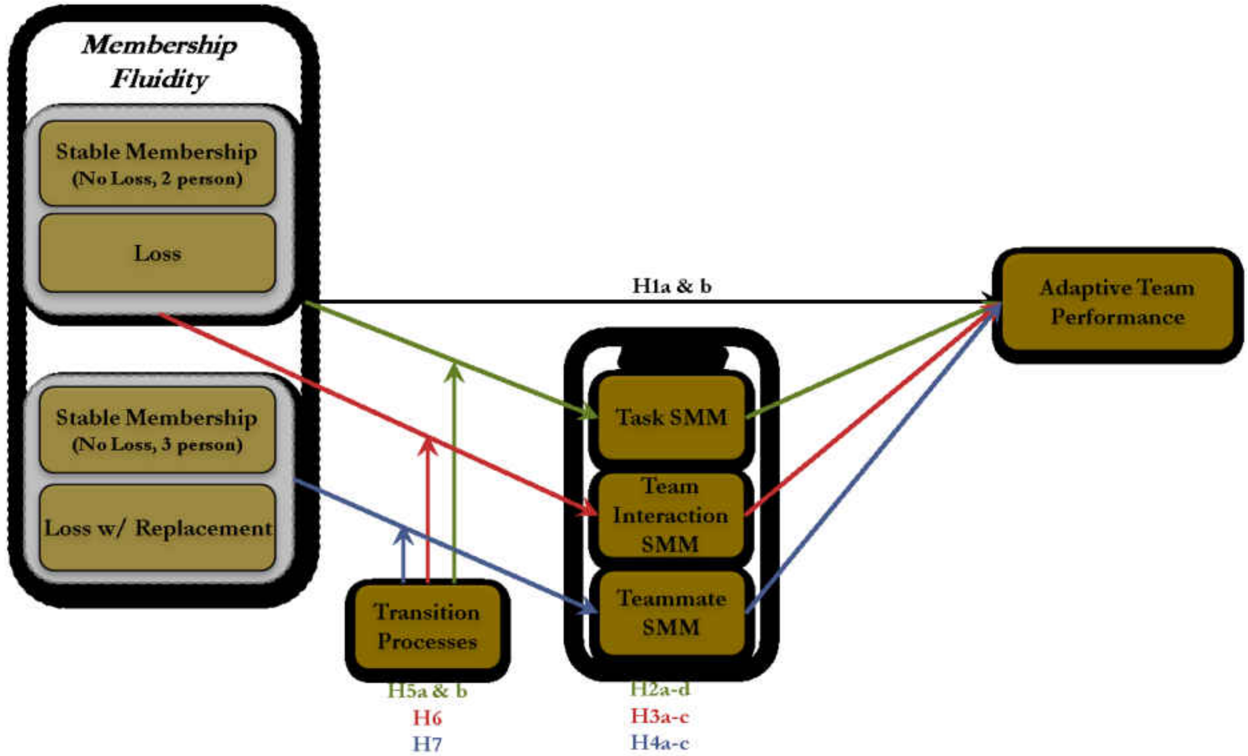

Figure 1. Hypothesized Relationships among Study Variables

Table 3

Summary of Study Hypotheses

H1a	Two-person intact teams will demonstrate greater adaptive performance than will two-person membership loss teams.
H1b	Three-person intact teams will demonstrate greater adaptive performance than will three-person membership loss with replacement teams.
H2a	Two-person intact teams will develop more similar Task MMs than two-person membership loss teams.
H2b	Three-person intact teams will develop more similar Task MMs than three-person membership loss with replacement teams.
H2c	Task MMs similarity will be positively related to adaptive performance.
H2d	Task SMMs will partially mediate the relationship between membership fluidity and adaptive team performance.
H3a	Two-person intact teams will develop more similar Team Interaction MMs than two-person membership loss teams.

H3b	Team Interaction MMs similarity will be positively related to adaptive performance.
H3c	Team Interaction SMMs will partially mediate the impact of membership loss and adaptive team performance for two-person teams.
H4a	Three-person intact teams will develop more similar Teammate MMs than three-person membership loss with replacement teams.
H4b	Teammate MM similarity will be positively related to adaptive performance.
H4c	Teammate SMMs will partially mediate the impact of membership replacement and adaptive team performance for three-person teams.
H5a	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.
H5b	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.
H6	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Team Interaction SMMs. The differences in Team Interaction MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.
H7	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Teammate SMMs. The differences in Teammate MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.

CHAPTER THREE: MATERIALS AND METHODS

Participants

Based on the power analysis (see design section below), 165 undergraduate and graduate students from two large Southeastern universities engaged in a simulation regarding an emergency room waiting area. Recruitment was conducted through two online systems designed to manage experiments, in accordance to policies outlined by the Institutional Review Board.

Participants were configured into 60 two- or three-person teams as follows: one control condition with two members (Condition 2: two-person intact teams; 15 total teams, 30 total participants) and one control condition with three members (Condition 3: three-person intact teams; 15 total teams, 45 total participants); two experimental conditions with three members each (Condition 4: membership loss teams and Condition 5: membership loss with replacement teams; 15 teams in each condition for a total of 30 experimental teams, 90 total participants). An attempt was made to recruit an equal number of male and female participants, resulting in 71 male participants, 93 female participants, and 1 participant who declined to answer. Across conditions, gender distribution ranged from 38% men (Condition 5: membership loss with replacement teams) to 47% men (Condition 4: membership loss teams & Condition 3: three-person intact teams). Age ranged from 18-57 years, with the majority of participants (66%) ranging between 18 and 21. Across conditions, the age ranged were 18-43 (Condition 5: membership loss with replacement teams), 18-57 (Condition 4: membership loss teams), 18-34 (Condition 3: three-person intact teams) and 18-44 (Condition 2: two-person intact teams).

All participants were randomly assigned to teams and to the experimental conditions under which they participated. A short training period was followed by two 20-minute simulation performance periods (referred to as Time 1 and Time 2). The simulation was similar for each performance period and identical across all conditions. Students received a cash stipend of $10 per hour in return for participation ($25 total for 2.5 hours). To ensure high levels of motivation throughout the experiment and to encourage teams to keep particular details of the manipulations confidential from potential future participants, participants were told upon arrival to the experimental session that they could win additional money based on their teams' performance. The top-performing team in each condition received $25 per participant; second- and third-place teams received $20 and $15 per participant, respectively. This monetary award was earned in addition to the individually based participation stipend of $25.

Design & Power Analyses

The study used a 4 (Membership Change: loss with replacement vs. loss without replacement vs. no change-three members vs. no change-two members; between factor) by 2 (Time 1, Time 2; within factor) mixed, factorial design. G*Power 3.1.3 was used to estimate the total sample size necessary to achieve a power of .80 assuming an medium effect size f^2 of .20 when assuming a linear multiple regression with a fixed model and single regression coefficient. A total minimum sample size of 32 teams was deemed necessary to detect the interaction of learning and membership change on adaptive performance (8 teams per cell). Further consideration was given to the *n:k* ratio to determine a more optimal sample size. Considering an 8:1 ratio with six variables (membership fluidity, information sharing, Task SMMs, Team Interaction SMMs, Teammate SMMs, and adaptive team performance), a suggested minimum sample size was 48 teams, which equals 12 teams per cell. However, to ensure adequate power, 60 teams (15/cell) were collected.

Procedure

Figure 2 summarizes the chronological flow of events prior to, and during, the experiment. Depending on the condition, either five or six participants arrived at the lab. There were two different experimenters to avoid: (1) confusion regarding which room to report to and (2) participants seeing one another and forming any kind of impression that they were all part of one team. To facilitate experimental protocols with research assistants, the teams in each condition were given names. For the experimental conditions, the team of three who experienced membership loss (Condition 4) was Team Bravo and the team of three who experienced membership change was Team Echo (Condition 5). For the control conditions, the team of three that remained intact was Team Delta (Condition 3) and the team of two that remained intact was Team Foxtrot (Condition 2).

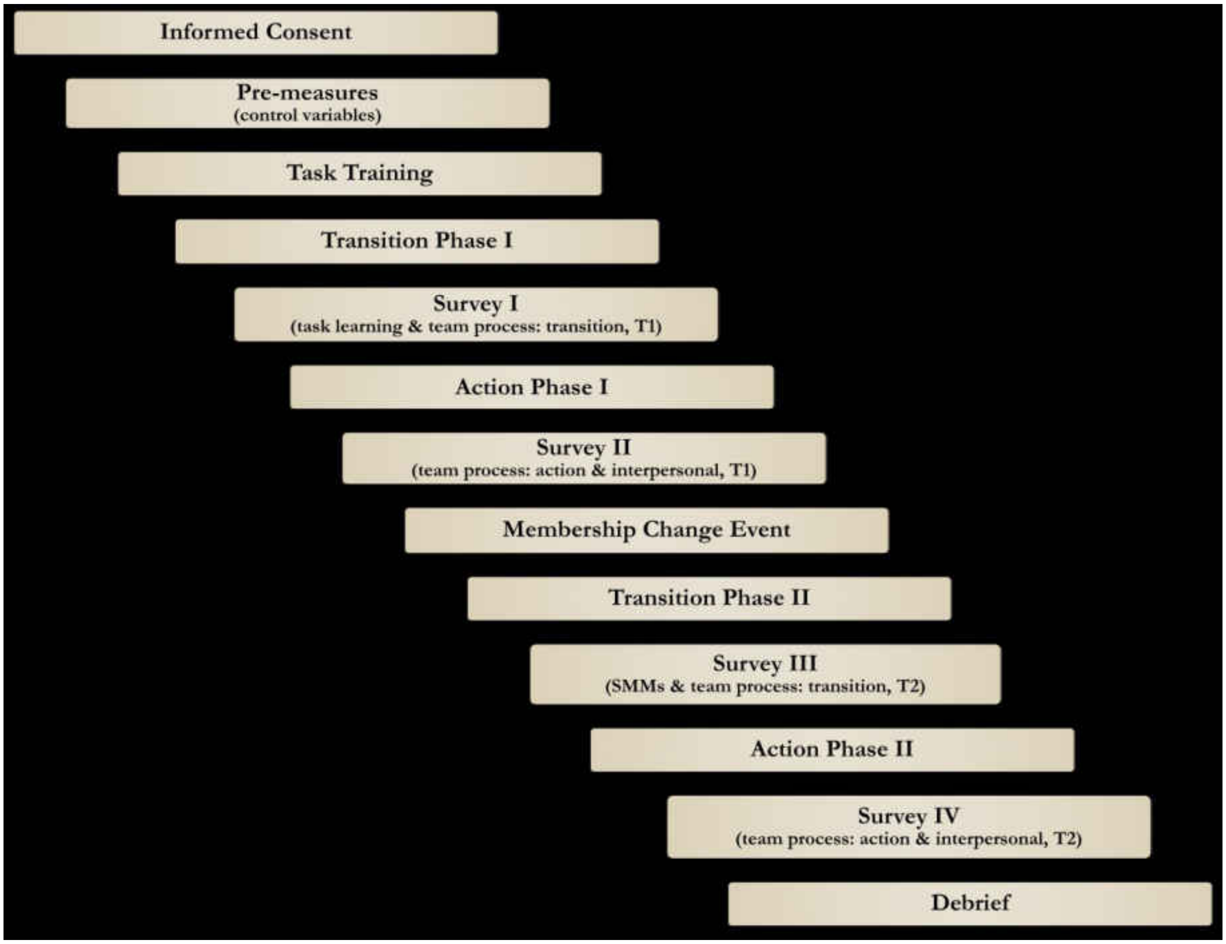

Figure 2. Chronological Flowchart Depicting Experimental Procedure

Upon arrival to the experiment, participants were told their purpose of working together on the simulation is to determine how teams interact with others. They were also told that another team was simultaneously working on the same simulation. Both teams were informed of the incentives associated with top performance. Immediately thereafter, the experimenter read the informed consent, explaining the nature of the experiment, while not giving away critical design details. Consent was waived, so participants were told that taking the first survey was a sign of their willingness to participate. Prior to the first survey, the experimenter provided participants with the opportunity to ask questions and reminded them that they could withdrawal from the study at any time.

Regardless of conditions, both teams in each experimental session received training in their separate locations. Once training was complete, all teams completed a series of measures, aimed at identifying familiarity with other members, the degree to which they felt comfortable with the simulation (e.g., the requirements) and other relevant control variable measures (see Appendix C).

The respective experimenter then provided each team with a worksheet (see Appendix D & E) to guide planning efforts that was tailored for either two-person teams (the two-person intact team condition) or three-person teams (all remaining conditions). Teams had 15 minutes to complete their planning period (i.e., Transition Phase I). Teams then completed a series of measures (see Appendix F) and then engaged with the simulation for roughly 20 minutes (i.e., Action Phase I). Upon completion of the first portion of the simulation, participants completed Performance Measure Time I as a team (see Appendix G, described in detail below), followed by another series of measures (see Appendix H). Once all members finished the measures, the experimenter removed a member from both *Team Bravo* (Condition 5 – membership loss with replacement) and *Team Echo* (Condition 4 – membership loss) in the experimental conditions and left membership intact in the two- and three-person control conditions (Conditions 2 and 3). In the membership loss with replacement condition (*Team Echo*), the lost member from *Team Bravo* joined *Team Echo*. All teams were then told to, "Take some time to plan for the next phase of the simulation. You have no more than five minutes." Either at the end of five minutes or when teams indicated they were finished planning (i.e., if before the five minutes were up), teams completed the third round of surveys (see Appendix I), which included the mental model measures. The difference in times for the planning periods was determined by pilot testing. Pilot teams across conditions rarely used more than five minutes and, in fact, the majority of teams did not use the full five minutes, regardless of condition. This held true during the experiment as well.

When ready, each team then engaged in the remaining 20-minutes of the simulation (i.e., Action Phase II, which was similar in nature to the first 20 minutes of the simulation), followed by the final measures (see Appendix J). During the simulation, the lost member from *Team Echo* completed the final round of measures, was debriefed, paid, and then told he/she was free to go. Once all members of a team finished the last round of measures, they were debriefed regarding the true nature of the study, paid for their time, and released.

Experimental Platform

Teams engaged in a computer-based simulation that recreated an emergency waiting room area. It was filmed as first-person; therefore, participants felt as though the actors were speaking directly to them (see *Figure 3*).

Figure 3. Screenshot from the Computer-based Emergency Room Simulation

There were three roles within the three-person teams: the *Waiting Room Volunteer Staffer*, *the Records Volunteer Staffer,* and the *Claims Volunteer Staffer*. The Waiting Room Volunteer Staffer interacted directly with the simulated patient questions, voicemails, and other office staff. This person also made necessary announcements when required (as dictated by the simulation). The Records

Volunteer Staffer had access to two documents as well as patient information files. The two documents were: (1) an employee tracking form (to keep track of every employee they saw in the simulation, date that employee arrived, and where that employee worked) and (2) a patient log form (similar to the employee tracking form except focused on the patients; see Appendix A). The Claims Volunteer Staffer had access to two additional documents as well as the patient information files: (1) an insurance claim form and (2) a complaint form to describe the nature of any complaints made against employees in the simulation and the individuals involved (see Appendix B). Participants in this role received messages from the billing department (aka, the experimenter) through a chat function and were asked to fill in missing patient information with information they found in the patient information files and/or the messages from the billing department. They also receive messages about formal complaints through the simulation.

In the two-person intact team condition, the roles of the Claims Staffer and the Records Staffer were combined so there were only two positions: Waiting Room Volunteer Staffer and Claims & Records Volunteer Staffer. The documents that were distributed between the Records Staffer and the Claims Staffer in the three-person conditions were combined and given to the Claims & Records Staffer in the two-person control condition.

Manipulations

All individuals and teams, regardless of experimental condition, received the same training on the simulation. This training consisted of a voice-enhanced PowerPoint that described the simulation as well as the various roles and associated tasks assigned to those roles.

Membership Change

There were four membership fluidity conditions: two-person intact teams (*Team Foxtrot*: control group with two members who remained as a team), three-person intact teams (*Team Delta*: control group with three members who remained as a team), membership loss teams (*Team Bravo:* three-person team who lost a member after the first performance cycle, leaving just two members), and membership loss with replacement teams (*Team Echo:* three person team who lost one member after the first performance cycle but simultaneously gained another member, resulting in a different configuration of three members). In the membership loss condition, remaining team members were told there were no replacement personnel available to assist. In the membership loss with replacement condition, the lost member from *Team Bravo* joined *Team Echo*. *Team Echo* was told that this new member from *Team Bravo* was now part of *Team Echo* to replace the lost original member. In both the membership loss and membership loss with replacement conditions, the Claims Volunteer Staffer was removed. That role worked closely with both the Waiting Room Volunteer Staffer and the Records Volunteer Staffer. Furthermore, the Claims Staffer received patient updates from the hospital staff (AKA - the experimenter). Therefore, removal of this member was likely to require the greatest amount of adaptation from teams (see Figure 4 for a visual representation of all four conditions at Time 1 and time 2).

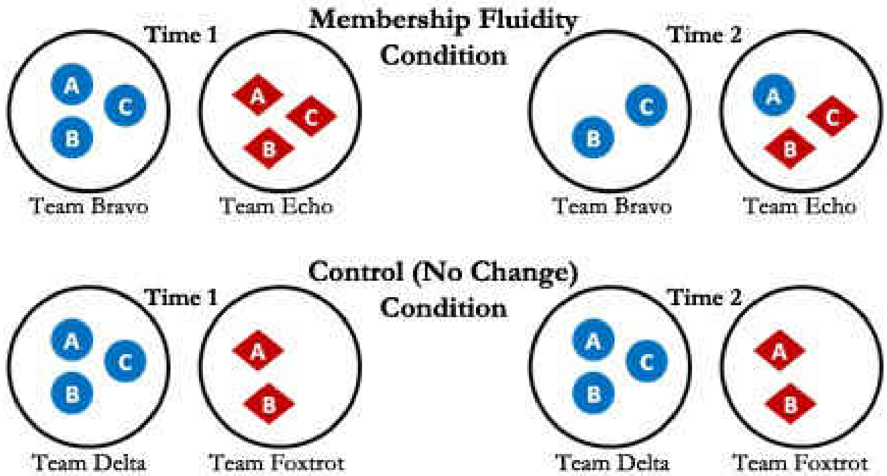

Figure 4. Team Member Configurations at Time 1 and Time 2

Measures

All survey data was collected using the Qualtrics online survey system, allowing for electronic data collection, except the SMM measures, which were conducted with pen and paper. All measures were completed in the laboratory. All self-report measures, unless otherwise noted, were rated on a 5-point Likert-type scale ranging from (1) strongly disagree to (5) strongly agree. See *Table 4* for an overview of the variables included in the study as well as operationalizations.

Table 4

List of Variables and Their Corresponding Operationalizations

Variable	**Operationalization**
	Control Variables
Demographic Information	Original scale capturing relevant demographic information of participants
Goal Orientation	13-item scale measuring an individual's disposition toward validating ability within achievement settings (Vandewalle, 1997)
Tolerance for Ambiguity	22-item scale measuring the manner in which individuals process information about ambiguous situations based on unfamiliar or complex clues (Furnham & Ribchester, 1995)
Familiarity	1-item scale, developed by Smith-Jentsch and colleagues, measuring the length of time participants had known one another in months (Rinke, 2011)
Role Comprehension	Original scale measuring the degree to which participants understand the requirements of the various role within the simulation

	Study Variables
Information Sharing	Coded from audio/video tapes based on (1) the total amount of information shared regarding team member knowledge, skills/abilities, or attitudes; (2) the total amount of time spent discussing such information; (3) the total amount of information shared regarding who will complete various roles, what the roles consist of, or how members should coordinate with each other regarding their respective roles; and (4) the total amount of time spent discussing such information
Learning	Operationalized as the level of sharedness of various types of mental models. • Team Interaction and Task Mental Models were measured by paired comparisons, similar to the method utilized by Smith-Jentsch and colleagues (2005). • Teammate Mental Models were measured using self-report comparisons to other reports of personality. This was assessed using the 20-item short form of the 50-item International Personality Item Pool-Five-Factor Model measuring the five factors of personality (Donnellan et al., 2006). • Both correlations and Euclidean distances were calculated for each SMM variable.
Performance T1 and T2	Original card-sorting task requiring the team to sort patients according to a triage scale (most severe to least severe); correct responses were aggregated to create a total score for each performance measurement period.
Adaptive Performance	Difference score between T1 and T2 performance

Control Variables

To statistically control for as much known variance as possible, a variety of conceptually- and empirically-related individual difference variables were measured and analyzed as potential control variables. The following measures were included in the initial survey that participants took in the lab immediately upon providing consent. These measures were selected as they are individual difference variables shown to be relevant to team adaptation in previous studies (e.g., DeRue et al., 2008; LePine, 2003, 2005). See Appendix C for each full-scale description.

Demographic information. The demographic survey included customary data such as age, gender, GPA, year in school, and major (among other data). GPA, specifically used as a covariate in this study across all analyses, was calculated as an average for the team. The mean across conditions was 2.85 (*SD* = 0.61). Skewness (-0.97) and kurtosis (0.96) levels across conditions were within acceptable ranges. The means within conditions were as follows: two-person intact teams (*M* = 3.14, *SD* = 0.45), three-person intact teams (*M* = 3.20, *SD* = 0.30), three-person membership loss teams (*M* = 3.33, *SD* = 0.42), and three-person membership loss with replacement teams (*M* = 3.23, *SD* = 0.39).

Goal Orientation. Goal orientation is defined as an individual's disposition toward validating ability within various achievement settings (Vandewalle, 1997). This was assessed using the Vandewalle's (1997) 13-item scale that categorizes goal orientation as Prove Performance, Avoid Performance, or Learning. An example item includes "I am willing to select a challenging work assignment that I can learn a lot from. Participants used the full range of responses (1-5), which were then aggregated into means for each subscale (Learning Goal Orientation - LGO, Prove Performance Goal Orientation – PPGO, and Avoid Performance Goal Orientation – APGO). In this study, APGO, consisting of a 4-item scale, (α = .82) was used as a covariate when analyzing the Task and Team Interaction SMM hypotheses. By definition, those high in APGO avoid situations that require them to perform. Thus, teams high in APGO could influence development of SMMs given the tendency to avoid demonstrating competence, which would result in a lack of cues required to develop SMMs regarding the specific tasks (Task SMMs) as well as how teams should go about approaching those tasks (Team Interaction SMMs). Team scores ranging from 1.50 to 4.00, with an overall mean across conditions was 2.60 (*SD* = .53). Skewness (0.08) and kurtosis (-0.07) levels across conditions were within acceptable ranges. Within conditions, APGO means were as follows: two-person intact teams (*M* = 2.54, *SD* = 0.72), three-person intact teams (*M* = 2.78, *SD* = 0.58), three-person membership loss teams (*M* = 2.62, *SD* = 0.32), and three-person membership loss with replacement teams (*M* = 2.46, *SD* = 0.39).

Tolerance for Ambiguity. Tolerance for ambiguity is defined as the manner in which an individual (or team) "perceives and processes information about ambiguous situations or stimuli when confronted by an array of unfamiliar, complex, or incongruent clues" (Furnham & Ribchester, 1995, p. 179). This was assessed using Mclain's (1993) 22-item measure (α = .87) and was used in the Task and Team Interaction SMM analyses. Example items include, "I generally prefer novelty over familiarity" and I enjoy tackling problems which are complex enough to be ambiguous." As this scale assesses the degree to which people are comfortable with ambiguity, using this measure as a covariate in these particular analyses removed variance associated with this comfort, allowing for consideration of variance related to the variables of interest rather than comfort (or lack thereof) with situations that are lacking clarity. Prior to aggregation, reverse coded items were re-scored; thus, higher team means indicated a higher overall level of ambiguity. Participants used the full range of responses (1-5), which were aggregated to the team level, resulting in a mean of 3.51 across conditions, (*SD* = 0.31). Skewness (0.14) and kurtosis (0.90) across conditions were within acceptable ranges. Means within conditions were as follows: two-person intact teams (*M* = 3.40, *SD* = 0.43), three-person intact teams (*M* = 3.49, *SD* = 0.32), three-person membership loss teams (*M* = 3.55, *SD* = 0.24), and three-person membership loss with replacement teams (*M* = 3.55, *SD* = 0.28).

Familiarity. Familiarity was defined in this study as the degree to which participants knew one another. This was measured using a scale developed for use with the simulation task by Smith-Jentsch and colleagues (Rinke, 2011). Familiarity was calculated as a team-level variable, averaging the level of familiarity among each dyadic pair within a team using one item – the number of months members had known one another. This was used as a control variable in analyses that considered Teammate SMMs, since greater familiarity could increase the amount of information known regarding a person's personality characteristics. Across conditions, the mean was 4.44 (*SD* = 8.46). Skewness (2.57) and kurtosis (6.79) levels across conditions suggest that the data was not normally distributed. Specifically, the positive skewness value suggests that the majority of the responses were less than the mean while the kurtosis level suggests that the data are more closely clustered around the mean (i.e., low lower levels of data fluctuation than what is seen in normal distributions). Together, this suggests that participants generally had low levels of familiarity. Within conditions, means were as follows: two-person intact teams (*M* = 1.00, *SD* = 2.36), three-person intact teams (*M* = 4.47, *SD* = 6.96), three-person membership loss teams (*M* = 4.83, *SD* = 9.04), and three-person membership loss with replacement teams (*M* = 7.45, *SD* = 11.96).

Role Comprehension. This original scale was designed to determine the degree to which the task training was effective. This is the only control variable measured after the initial transition phase (see Appendix F) and was used in all analyses as it directly influences Task as well as Team Interaction SMMs. Specifically, the more clarity members have regarding the roles, the better able they would be to determine what tasks are critical and how to coordinate to accomplish those tasks. The scale was either 2-items or 3-items, depending on the number of team members (2-item for two-person intact teams, 3-items for all other conditions). The items asked whether members understood the requirements of their own roles as well as the roles of the other team members. The mean across conditions was 3.73 (*SD* = 0.43). Skewness (0.31) and kurtosis (1.46) levels across conditions were within acceptable ranges. Means within conditions were as follows: two-person intact teams (*M* = 3.63, *SD* = 0.52), three-person intact teams (*M* = 3.67, *SD* = 0.41), three-person membership loss teams (*M* = 3.84, *SD* = 0.43), and three-person membership loss with replacement teams (*M* = 3.78, *SD* = 0.36).

Study Variables

The following describes the operationalization of the key study constructs. These measures were given throughout the study (refer back to the experimental flow, depicted in Figure 2).

Information Sharing. This was operationalized as the amount of information shared regarding (1) team member knowledge, skills/abilities, or attitudes or any type of teamwork process (i.e., back-up behavior, mutual monitoring, etc.) and (2) taskwork. This was coded based on review of audio/video tapes of each study session—specifically of the second transition phase (second planning period). Each piece of relevant information shared counted in the total. For example, a phrase stated from the Records Staffer to the Claims Staffer saying, "You need to write down all of the patient information you get, and if you need help with this, let me know" would be coded as one unique task-relevant statement and one unique team-relevant statement. The portion discussing writing down all relevant patient information is a task that is required of the Claims Staffer (or the Claims & Records staffer, in the two-person intact teams). The portion of the statement offering assistance if requested describes back-up behavior and thus, would be coded as one unique team-related statement. These counts were aggregated to create a total amount of information-shared variable. Three research assistants engaged in coding. The inter-rater reliability (ICC) was .93. Skewness (0.42) and kurtosis (-0.74) levels were within acceptable ranges across conditions. The overall mean across conditions was 9.23 (SD = 6.04). Within conditions, means were as follows: two-person intact teams (M = 5.40, SD = 3.60), three-person intact teams (M = 9.20, SD = 6.41), three-person membership loss teams (M = 10.93, SD = 4.74), and three-person membership loss with replacement teams (M = 11.40, SD = 7.30).

Learning. Learning was operationalized as the development of shared mental models regarding team interaction and regarding the task (see Appendix I) and analyzed as outlined by Smith-Jentsch and colleagues (2005). SMM similarity was calculated as an average correlation between team members. This is the identical method utilized by Smith-Jentsch and colleagues (2005), who argued that such an approach is warranted because these indices are correlational in nature and thus, are parallel to the use of Pathfinder C (e.g., Marks, Sabella, Burke, & Zaccaro, 2002; Stout, Cannon-Bowers, Salas, & Milanovich, 1999), UCFNET QAP coefficients (e.g., Mathieu et al., 2000), or coefficient alpha across respondents (e.g., Webber, Chen, Payne, Marsh, & Zaccaro, 2000). This was calculated for each team. As this is a correlation, it is interpreted in the same way as other correlations—the higher the correlation (closer to 1), the greater the level of similarity among MMs.

A correlation index measures the general similarity of the pattern of responses among participants on the SMM matrices. To capture the absolute distance between participant ratings, a Euclidean distance was also calculated between all possible dyadic MM matrices (and personality ratings) as well and then averaged within team to create a team score. This represents how closely participant ratings actually were, regardless of the pattern of responses. Thus, the lower the calculated distance score, the closer the ratings or more similar the mental models.

Data for the team interaction and taskwork SMMs were analyzed using a structured network approach (e.g., paired comparisons) as research has demonstrated that such an approach to measuring mental models is most predictive of adaptive team performance (Resick et al., 2010). Therefore, participants were presented with a matrix comparing each of the required tasks to one another to assess task MMs. Participants were instructed to rate each attribute in relation to all other attributes for that model based on a 5-point scale ranging from *-4 (negatively related, a high degree of one requires a low degree of the other)* through 0 (*unrelated)* to 4 *(positively related, a high degree of one requires a high degree of the other)*. Team interaction MMs were measured utilizing a similar matrix. Relevant team attributes included (1) goal specification, (2) strategy formulation, (3) team monitoring and backup behaviors, (4) coordination activities, (5) conflict management, (6) motivating/confidence building, and (6) affect management. The ratings were completed before the action phase of the second performance episode (i.e., after the membership change) to indicate the amount of learning that occurred during the first performance cycle. This reflected the sharedness of knowledge *after* members were exchanged or left teams. Skewness and kurtosis levels were within acceptable ranges for each index of the Task and Team Interaction SMMs: Task similarity (-0.09, -1.22), Task distance (0.55, 0.39), Team Interaction similarity (0.68, 0.11), and Team Interaction distance (0.72, 1.02). Overall means and standard deviations across conditions for each index are as follows: Task similarity (M = 0.38, SD = 0.24), Task distance (M = 12.00, SD = 3.92), Team Interaction similarity (M = 0.13, SD = 0.23), and Team Interaction distance (M = 9.48, SD = 3.21). Means within conditions for Task MM similarity are as follows: two-person intact teams (M = 0.46, SD = 0.25), three-person intact teams (M = 0.32, SD = 0.20), membership loss teams (M = 0.32, SD = 0.28), and membership loss with replacement teams (M = 0.42, SD = 0.23). Means within conditions for Team Interaction MM similarity are as follows: two-person intact teams (M = 0.16, SD = 0.28), three-person intact teams (M = 0.14, SD = 0.19), membership loss teams (M = 0.14, SD = 0.26), and membership loss with replacement teams (M = 0.09, SD = 0.17). Means within conditions for Task MM distance are as follows: two-person intact teams (M = 11.45, SD =4.91), three-person intact teams (M = 11.89, SD = 2.07), membership loss teams (M = 13.15, SD = 4.21), and membership loss with replacement teams (M = 11.50, SD = 4.08). Finally, means within conditions for Team Interaction MM distance are as follows: two-person intact teams (M = 8.61, SD = 3.28), three-person intact teams (M = 10.17, SD = 3.49), membership loss teams (M = 10.34, SD = 3.61), and membership loss with replacement teams (M = 8.82, SD = 2.18).

Teammate SMMs were calculated using personality measures of the self, as compared to personality ratings by others. Recall that Teammate SMMs includes general preferences for working as well as levels of expertise. This particular study was focused on ad hoc teams engaging in customer service related tasks. Therefore, the personality dimension of Teammate SMMs was the most appropriate measure given the nature of the work. Team members would have more opportunity to observe personality characteristics than any level of expertise. Personality was measured using the mini-IPIP, a 20-item short form of the 50-item International Personality Item Pool-Five-Factor Model measure (Donnellan, Oswald, Baird, & Lucas, 2006). Items cover openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism. Each member was required to complete this measure about themselves and about every other member of the team. To compute similarity and distance indices, a mean was calculated for each subscale (i.e., openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism) per person. These means were then compared for each dyadic pair within the team (self to other rating of self). These dyadic comparisons were then averaged to create a "team member" average and all team member averages were aggregated, using the mean, to create a teammate similarity SMM index or distance SMM index. These team level variables were used in all analyses. Skewness and kurtosis levels were within acceptable ranges for both the similarity (-0.60, 0.43) and distance (-0.01, -0.42) indices. Overall means and standard deviations across conditions for each index are as follows: similarity (M = 0.47, SD = 0.27) and distance (M = 2.25, SD = 0.45). Within conditions, means were as follows for the similarity index: two-person intact teams (M = 0.56, SD = 0.32), three-person intact teams (M = 0.50, SD = 0.26), three-person membership loss teams (M = 0.37, SD = 0.26), and three-person membership loss with replacement teams (M = 0.44, SD = 0.23). For the distance index, means within conditions were as follows: two-person intact teams (M = 2.08, SD = 0.49), three-person intact teams (M = 2.22, SD = 0.41), three-person membership loss teams (M = 2.31, SD = 0.47), and three-person membership loss with replacement teams (M = 2.39, SD = 0.42).

Performance Time 1 and Time 2. This was measured using a card-sorting type task designed to be completed as a team (see Appendix G). Participants were given a specified amount of time (five minutes) to place participants within the correct triage level (Level 1 through Level 4). As knowledge about patients specific problems is distributed among team members (e.g., not all patients needing care are seen in the simulation or listed in patient files as some are sent via critical update messages to the Claims Volunteer Staffer and thus, neither the Waiting Room Volunteer Staffer nor the Records Volunteer Staffer would have complete knowledge of all patients), all members needed to work together to successfully identify the correct ranking. A similar card-sorting task was given at the termination of the second performance period. Teams were given four minutes to complete the second measure. This reduction in time was to induce the same level of time pressure felt during the first performance assessment. As teams were accustomed to the triage level scale for the second performance period, there was no need for additional time to allow members to familiarize each other with the scale levels. The timings for both performance periods were determined through pilot testing.

Scores for Performance Time I ranged from 0 to 10 (M = 4.10, SD = 2.36). Skewness (0.14) and kurtosis (-0.36) across conditions were within acceptable ranges. Within conditions, means for Performance Time I were as follows: two-person intact teams (M = 4.40, SD = 2.41), three-person intact teams (M = 3.93, SD = 1.98), three-person membership loss teams (M = 3.47, SD = 2.45), and three-person membership loss with replacement teams (M = 4.60, SD = 2.64). Scores for Performance Time II ranged from 0 to 11 (M = 5.12, SD = 2.44). Again, skewness (-0.03) and kurtosis (-0.60) levels were within acceptable ranges across conditions. Within conditions, means for Performance Time II were as follows: two-person intact teams (M = 5.07, SD = 1.95), three-person intact teams (*M* = 5.80, *SD* = 2.54), three-person membership loss teams (*M* = 4.87, *SD* = 2.50), and three-person membership loss with replacement teams (*M* = 4.73, *SD* = 2.82).

Adaptive Performance. Adaptive performance was calculated using a difference score between Performance Time 1 and Performance Time 2 (Time 2 – Time 1). Scores for Adaptive Performance ranged from -7 to 7 (*M* = 1.02, *SD* = 2.87). Negative scores indicate that team performance decreased from Time I to Time II. Positive scores indicate that team performance increased from Time I to Time II. A change score of 0 indicated consistency across performance assessments. The skewness (-0.10) and kurtosis (0.17) values were in acceptable ranges across conditions, yet the negative skewness value suggests that the majority of scores were on the positive side of the scale. Indeed, frequency counts support this as 71.6 percent of scores were 0 (no change) or positive (increase in performance). Means for Adaptive Performance within conditions were as follows: two-person intact teams (*M* = 0.67, *SD* = 1.95), three-person intact teams (*M* = 1.87, *SD* = 2.50), three-person membership loss teams (*M* = 1.40, *SD* = 3.23), and three-person membership loss with replacement teams (*M* = 0.13, *SD* = 3.50). Skewness and kurtosis levels within conditions were also within acceptable ranges: two-person intact teams (0.54, 0.14), three-person intact teams (0.27, 0.52), three-person membership loss teams (0.45, -1.19), and three-person membership loss with replacement teams (-0.58, -0.41).

Statistical Analyses

Hypotheses 1a & b were testing the main effect of membership fluidity on adaptive performance. Hypotheses 2-4 were testing the mediating effects of learning (operationalized as Task, Team Interaction, and Teammate SMMs) on this relationship. Hypotheses 5-7 are testing the moderating effects of information sharing on the development of SMMs. Although tests of such mediation hypotheses have traditionally been guided by a multistep process proposed by Baron and

Kenny (1986), recent work suggests there are methodological shortcomings to this multistep approach (e.g., J. R. Edwards & Lambert, 2007; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Specifically, researchers suggest there is no need to demonstrate significance between the input and the output variables as there are cases in which these variables may not be significantly related (e.g., distal mediation). In response to such criticism, Kenny and colleagues (Kenny, Kashy, & Bolger, 1998) presented an updated account suggesting modifications to their original process.

Preacher and Hayes (2004), therefore, suggest a different—more powerful—approach to testing mediation, especially moderated mediation (the focus of this effort). The technique, based on the modified approach to the Sobel (1982) test, is called bootstrapping. To assist in such analyses, Preacher, Rucker, and Hayes (2007) developed an SPSS macro that enables estimation of indirect effects by comparing the normal theory approach (e.g., the Sobel test; Sobel, 1982), the bootstrap method to obtain confidence intervals, and the stepwise procedure advocated by Barron and Kenny (Baron & Kenny, 1986). As the main model in this effort is moderated mediation (i.e., SMMs mediate the relationship between membership fluidity and performance and information sharing moderates the degree to which condition influences SMMs), the bootstrapping method was used to test all hypotheses.

Specifically, data analyses was conducted as follows: Adaptive Performance (DV) was regressed onto membership condition (IV—either comparing two-person intact teams to membership loss teams OR three-person intact teams to membership loss with replacement teams) as well as the various SMM measures (mediators) to determine whether learning (operationalized as development of highly shared mental models) mediated the relationship between membership fluidity and adaptive team performance. In subsequent analyses, the transition process measure (operationalized as information sharing, obtained by coding each team's second planning period—or transition phase—for task and team relevant information sharing) was used as a moderator in the moderated mediation bootstrapping analysis. The SPSS macro (Preacher et al., 2007)allows for integration of moderating variables when testing mediation to avoid family-wise error and to present a more holistic picture of the indirect relationship between the IV (Condition) and DV (Adaptive Performance) through the mediator (SMMs) at various levels of the moderator (Information Sharing). See Table 5 for a summary of all regression-based equations used in hypothesis testing. All models were tested using two different mental model metrics (each run separately), first with SMM correlations (index of similarity of pattern ratings) and second with SMM Euclidean distances (index of absolute agreement). This was done to consider whether the relative patterns or the absolute agreement of ratings were more predictive as previous research has demonstrated variability in results when using different mental model metrics in analyses (Smith-Jentsch, 2009).

Table 5

Summary of Regression-Based Statistical Analyses

	Mediation Analyses with Direct and Indirect Effect
Conditions 2 & 4: Task SMMs	Performance Time II = $b_0 + a_0 b_m + (b_x + a_x b_m)$ Conditions 2 & 4 + $e_{Performance} + b_m e_{Task\ SMMs}$
Condition 3 & 5: Task SMMs	Performance Time II = $b_0 + a_0 b_m + (b_x + a_x b_m)$ Conditions 3 & 5 + $e_{Performance} + b_m e_{Task\ SMMs}$
Conditions 2 & 4: Team Interaction SMMs	Performance Time II = $b_0 + a_0 b_m + (b_x + a_x b_m)$ Conditions 2 & 4 + $e_{Performance} + b_m e_{Team\ Interaction\ SMMs}$
Conditions 3 & 5: Teammate SMMs	Performance Time II = $b_0 + a_0 b_m + (b_x + a_x b_m)$ Conditions 3 & 5 + $e_{Performance} + b_m e_{Teammate\ SMMs}$
	Moderated Mediation Analyses with Direct and Indirect Effect
Conditions 2 & 4: Task SMMs	Performance Time II = $[b_0 + (a_0 + a_z$ Information Sharing$)b_m] + [b_x + (a_x + a_{xz}$ Information Sharing) Conditions 2 & 4 + $e_{Performance} + b_m e_{Task\ SMMs}$
Condition 3 & 5: Task SMMs	Performance Time II = $[b_0 + (a_0 + a_z$ Information Sharing$)b_m] + [b_x + (a_x + a_{xz}$ Information Sharing) Conditions 3 & 5 + $e_{Performance} + b_m e_{Task\ SMMs}$
Conditions 2 & 4: Team Interaction SMMs	Performance Time II = $[b_0 + (a_0 + a_z$ Information Sharing$)b_m] + [b_x + (a_x + a_{xz}$ Information Sharing) Conditions 2 & 4 + $e_{Performance} + b_m e_{Team\ Interaction\ SMMs}$
Conditions 3 & 5: Teammate SMMs	Performance Time II = $[b_0 + (a_0 + a_z$ Information Sharing$)b_m] + [b_x + (a_x + a_{xz}$ Information Sharing) Conditions 3 & 5 + $e_{Performance} + b_m e_{Team\ Interaction\ SMMs}$

Note: subscripts on regression coefficients indicate the variable to which the coefficient is assigned. Therefore, b_X refers to the IV coefficient (X), b_m refers to the mediator coefficient (M), and a_z refers to the moderator coefficient (Z). All intercepts have a zero subscript, and residual terms are subscripted with the appropriate DV (i.e., DV of Performance—$e_{Performance}$ or Mediator of the particular SMM--$e_{task\ SMMs}$). Finally, to differentiate among equations that use performance as the DV, coefficients are symbolized with the letter "b," whereas in equations using the mediator (SMMs) as the DV, coefficients are symbolized with the letter "a." See Edwards & Lambert (2007) for a more detailed review of the origin of each equation.

CHAPTER FOUR: RESULTS

IBM SPSS Statistics 20.0 for Windows was used to test all study hypotheses. As expected, there was no significant difference in Time I Performance across the four experimental conditions, $F(3,56) = 0.68$, $p = .57$, $\eta^2 = .04$, suggesting no spurious differences among conditions from the random assignment. To rule out the possibility that team size influenced performance differences, all comparisons between conditions were limited to teams of equal size. Therefore, the two-person intact teams (Condition 2) was always compared to the membership loss teams (Condition 4) and the three-person intact teams (Condition 3) was compared to the membership loss with replacement teams (Condition 5). Pearson product-moment correlation results and descriptive statistics for all study variables are reported in Table 6. Tables 7-10 contain the performance variables for each condition (two-person intact team – Table 7, three-person intact team – Table 8, membership loss team – Table 9, and membership loss with replacement team – Table 10).

Table 6

Intercorrelations, Means, & Standard Deviations for Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Task SMM Corr.	--														
2. Team Interaction SMM Corr.	-.01	--													
3. Teammate SMM Corr.	.12	-.01	--												
4. Task SMM Euc. Dist.	-.51**	-.14	-.34**	--											
5. Team Interaction SMM Euc. Dist.	-.11	-.18	-.28*	.32	--										
6. Teammate SMM Euc. Dist.	-.14	.07	-.54**	.17	.08	--									
7. Total Info Sharing Amount	-.01	-.07	-.08	-.02	-.01	.30*	--								
8. GPA (Average for Team)	-.05	-.20	.22	-.23	-.26	-.05	.13	--							
9. APGO (Team)	-.08	.04	.08	.10	-.02	.03	.08	.05	--						
10. Tolerance for Ambiguity (team)	-.25	.10	.02	-.01	-.17	.003	.15	.09	-.49**	--					

11. Team Familiarity	-.09	.09	.06	-.03	.18	.08	.09	.15	.01	.12	--				
12. Role Comprehension	-.06	.08	-.07	-.04	.07	.03	-.03	-.08	-.08	.09	-.10	--			
13. Performance Time I	.04	.16	.19	.06	-.17	-.04	.12	.09	-.001	.26*	-.05	-.11	--		
14. Performance Time II	-.002	.14	.16	-.06	-.16	-.05	.000	.12	.06	.18	-.13	.07	.29*	--	
15. Adaptive Performance	-.03	-.01	-.02	-.10	.01	-.01	-.10	.03	.05	-.07	-.07	.15	-.58**	.61**	--
M	0.38	0.13	0.47	12.00	9.48	2.25	9.23	3.23	2.60	3.50	4.44	3.73	4.10	5.12	1.02
SD	0.14	0.23	0.27	3.92	3.21	0.45	6.04	0.39	0.53	0.33	8.46	0.43	2.36	2.44	2.87

Table 7

2-Person Intact Teams-Intercorrelations, Means, & Standard Deviations for Performance Variables

	1	2	3
1. Performance Time I	--		
2. Performance Time II	.62*	--	
3. Adaptive Performance	-.62*	.23	--
M	4.40	5.01	0.67
SD	2.41	1.95	1.95

Table 8

3-Person Intact Teams-Intercorrelations, Means, & Standard Deviations for Performance Variables

	1	2	3
1. Performance Time I	--		
2. Performance Time II	.41	--	
3. Adaptive Performance	-.38	.69**	--
M	3.93	5.80	1.87
SD	1.98	2.54	2.50

Table 9

Membership Loss Teams-Intercorrelations, Means, & Standard Deviations for Performance Variables

	1	2	3
1. Performance Time I	--		
2. Performance Time II	.15	--	
3. Adaptive Performance	-.64**	.66**	--
M	3.47	4.87	1.40
SD	2.45	2.50	3.23

Table 10

Membership Loss w/ Replacement Teams-Intercorrelations, Means, & SDs for Perf. Variables

	1	2	3
4. Performance Time I	--		
5. Performance Time II	.18	--	
6. Adaptive Performance	-.61*	.67**	--
M	4.60	4.73	0.13
SD	2.64	2.82	3.50

Mediation Results

Shared mental models were hypothesized to mediate the relationship between membership fluidity condition and adaptive performance. As such, the first several hypotheses (1-4) were analyzed using the basic mediation model seen in Figure 5. Results are presented below based on the type of SMM index (similarity or distance).

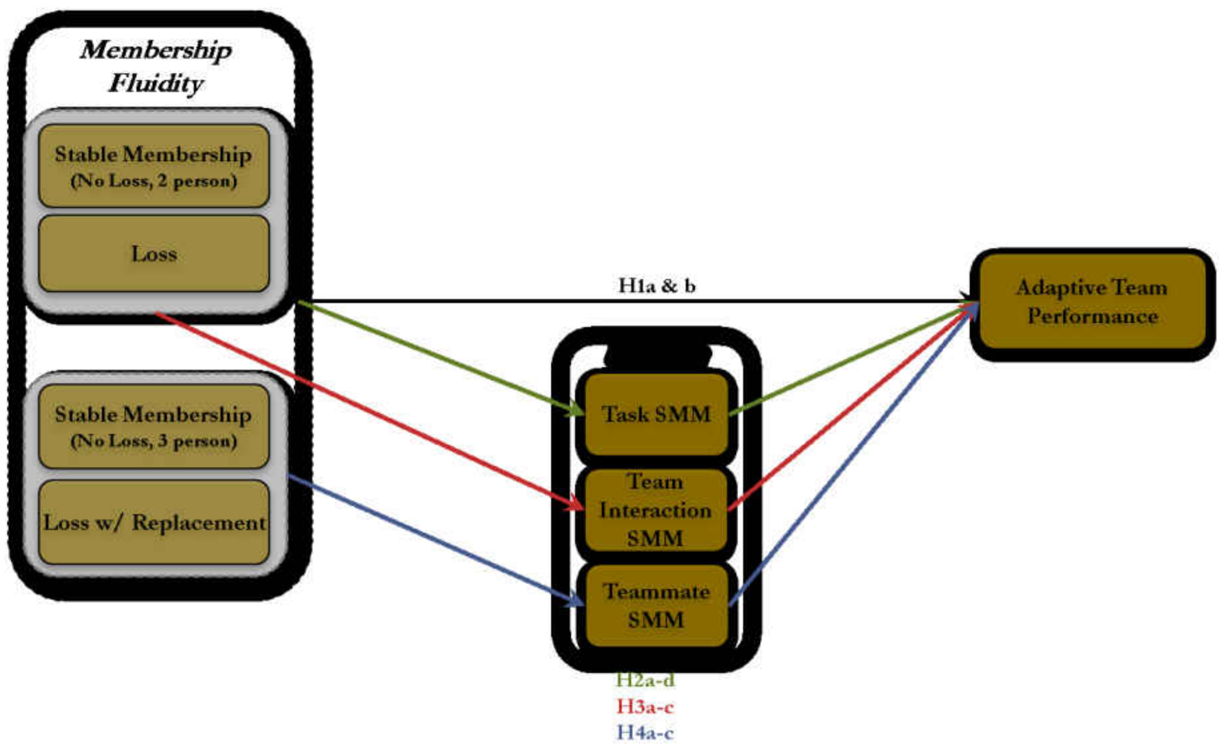

Figure 5. Basic Mediation Model

H1-4 Results: Two-Person Intact vs. Membership Loss Teams

Hypotheses 2a, c, and d suggested that Task SMMs would partially mediate the relationship between membership fluidity (two-person intact teams and membership loss teams) and adaptive team performance. As indicated in Table 11, results do not support the mediation hypotheses for Condition 2 – two-person intact teams and Condition 4 – membership loss teams when mental models were operationalized using the similarity index. Task SMMs were not significantly related to condition, $\beta = -0.01$, $t = -0.14$, $p = .89$, two-tailed. Task SMMs were also not significant predictors of Team Performance, $\beta = -0.50$, $t = -0.19$, $p = .85$, two-tailed. The indirect effect of condition on performance was not in the hypothesized direction ($\beta = 1.05$), nor was it significant ($p = .38$, two-tailed). Furthermore, the two-tailed significance test assuming normal distribution demonstrated a non-significant effect (Sobel $z = 0.03$, $p = .97$), which was confirmed by the bootstrap results as the confidence interval contained zero (-0.57, 0.89). Therefore, the similarity index for Task SMMs for two-person intact teams as compared to membership loss teams did not support Hypotheses 2a, 2c, or 2d.

Hypotheses 3a-c suggested Team Interaction SMMs would partially mediate the relationship between membership fluidity (two-person intact teams and membership loss teams) and adaptive team performance. Table 11 provides these results as well, which do not support mediation. Team Interaction SMMs were not significantly related to condition, $\beta = -0.09$, $t = -0.78$, $p = .44$, two-tailed. Furthermore, Team Interaction SMMs were not significant predictors of Team Performance, $\beta = -2.29$, $t = -0.98$, $p = .34$, two-tailed. Additionally, the two-tailed significance test assuming normal distribution demonstrated a non-significant effect for Team Interaction SMMs (Sobel $z = 0.48$, $p = .63$), which was confirmed by the bootstrap results as the confidence interval contained zero (-0.22, 2.50). Therefore, the similarity index for Team Interaction SMMs for two-person intact teams as compared to membership loss teams did not support Hypotheses 3a-c.

Interestingly, condition was found to be a significant predictor of Teammate SMMs, when operationalized as the similarity index, $\beta = -0.32$, $t = -2.86$, $p = .01$, two-tailed. Two-person intact teams developed more similar Teammate MMs as compared to membership loss teams. In membership loss teams, there is no new member (as compared to membership loss with replacement teams) so there is no additional person for the team to integrate. Furthermore, it is easier to develop sharedness among fewer members. Thus, this relationship was not predicted.

Table 11

Mediation: SMM Correlations, 2-person Intact & Membership Loss Teams

Variable	β	*SE*	*t*	*p*	*Confidence Interval* *LL 95% CI*	*UL 95% CI*
Direct and Total Effects						
Adaptive Performance Regressed on Condition[a]	0.33	1.49	0.22	.83	-2.77	3.42
Task SMMs Regressed on Condition[a]	-0.01	0.10	-0.14	.89	-0.23	0.20
Team Interaction SMMs Regressed on Condition[a]	-0.09	0.11	-0.78	.44	-0.31	0.14
Teammate SMMs Regressed on Condition[a]	**-0.32**	**0.11**	**-2.86**	**.01***	**-0.55**	**-0.09**
Adaptive Performance Regressed on Task SMMs, controlling for Condition[a]	-0.50	2.64	-0.19	.85	-6.00	5.00
Adaptive Performance Regressed on Team Interaction SMMs, controlling for Condition[a]	-2.29	2.34	-0.98	.34	-7.16	2.59
Adaptive Performance Regressed on Teammate SMMs, controlling for Condition[a]	-1.65	2.50	-0.66	.52	-6.84	3.54
Adaptive Performance Regressed on Condition[a], controlling for SMMs (Total Effects Model)	1.05	1.18	0.89	.38	-1.38	3.49
	Effect	*SE*	*z*	*p*		
Indirect Effect and Significance Using Normal Theory						
Sobel – Task SMMs	0.01	0.28	0.03	.97		
Sobel – Team Interaction SMMs	0.20	0.41	0.48	.63		
Sobel – Teammate SMMs	0.53	0.86	0.61	.54		
	Effect	*Boot SE*			*Bootstrap Confidence Interval* *LL 95% CI*	*UL 95% CI*
Bootstrap Results for Indirect Effect						
Task SMMs	0.01	0.36			-0.57	0.89
Team Interaction SMMs	0.20	0.51			-0.22	2.50
Teammate SMMs	0.53	1.20			-1.39	3.55

Note. n = 30 teams. Bootstrap sample size = 5,000. LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 2 (2-Person Intact Teams) & 4 (Membership Loss Teams), Controlling for Average GPA, APGO, Tolerance for Ambiguity, & Role Comprehension. *p = .005, 1-tailed.

When using the relative distance SMM metric, the pattern of results change. As noted in Table 12, Task SMMs, operationalized as the Euclidean distance between team member mental models, was significantly predicted by condition, β = 3.21, t = 1.70, p = .05, one-tailed. Essentially, membership loss teams had greater distance among their Task MMs than two-person intact teams. Similarly Team Interaction SMMs were significantly predicted by condition, $\beta = 3.86$, $t = 3.24$, $p = .002$, one-tailed. These results do not support mediation. The two-tailed significance test assuming normal distribution demonstrated a non-significant effect for both Task (Sobel $z = -0.04$, $p = .97$) and Team Interaction SMMs (Sobel $z = -0.35$, $p = .72$), which was confirmed by the bootstrap results, as the confidence interval contained zero for both SMMs (Task: -0.02, 0.80; Team Interaction: -0.33. 1.00). Therefore, Hypotheses 2a and 3a were supported; however, Hypotheses 2c, 2d, 3b, and 3c were not supported for two-person intact teams as compared to membership loss teams when SMMs were operationalized as Euclidean distance.

Based on the results of both of these tests (as reported in Tables 11 and 12), condition did not significantly predict adaptive team performance for two-person intact teams as compared to membership loss teams, as hypothesized. Therefore, there was no support for Hypothesis 1a.

Table 12

Mediation: SMM Euclidean Distance, 2-person Intact & Membership Loss Teams

Variable	β	*SE*	*t*	*p*	*Confidence Interval*	
					LL 95% CI	*UL 95% CI*
			Direct and Total Effects			
Adaptive Performance Regressed on Condition[a]	1.34	1.52	0.88	.39	-1.83	4.51
Task SMMs Regressed on Condition[a]	**3.21**	**1.89**	**1.70**	**.10***	**-0.69**	**7.11**
Team Interaction SMMs Regressed on Condition[a]	**3.86**	**1.19**	**3.24**	**.004****	**1.40**	**6.31**
Teammate SMMs Regressed on Condition[a]	0.23	0.22	1.09	.29	-0.21	0.68
Adaptive Performance Regressed on Task SMMs, controlling for Condition[a]	-0.01	0.15	-0.05	.97	-0.31	0.30
Adaptive Performance Regressed on Team Interaction SMMs, controlling for Condition[a]	-0.09	0.23	-0.37	.71	-0.56	0.39
Adaptive Performance Regressed on Teammate SMMs, controlling for Condition[a]	0.27	1.29	0.21	.84	-2.41	2.95
Adaptive Performance Regressed on Condition[a], controlling for SMMs (Total Effects Model)	1.05	1.18	0.89	.38	-1.38	3.49
	Effect	*SE*	*z*	*p*		
			Indirect Effect and Significance Using Normal Theory			
Sobel – Task SMMs	-0.02	0.54	-0.04	.97		
Sobel – Team Interaction SMMs	-0.33	0.93	-0.35	.72		
Sobel – Teammate SMMs	0.06	0.41	0.15	.88		
					Bootstrap Confidence Interval	
	Effect	*Boot SE*			*LL 95% CI*	*UL 95% CI*
			Bootstrap Results for Indirect Effect			
Task SMMs	-0.02	0.80			-1.74	1.67
Team Interaction SMMs	-0.33	1.00			-2.68	1.42
Teammate SMMs	0.06	0.56			-0.80	1.82

Note. n = 30 teams. Bootstrap sample size = 5,000. LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 2 (2-Person Control) & 4 (Membership Loss)

H1-4 Results: Three-Person Intact & Membership Loss w/Replacement Teams

As reported in Table 13, analyses were conducted to test the mediating hypotheses for three-person intact teams as compared to membership loss with replacement teams. When operationalized using the similarity index, neither Task SMMs (β = 0.11, t = 1.23, p = .23, two-tailed) nor Teammate SMMs (β = -0.08, t = -0.88, p = .39, two-tailed) were predicted by condition. However, condition did significantly predict adaptive performance in the hypothesized direction, β = -2.06, t = -1.79, p = .04, one-tailed. Given the pattern of findings, mediation was not supported as the two-tailed significance test assuming normal distribution revealed a non-significant effect for both Task SMMs (Sobel z = -0.15, p = .88) and Teammate SMMs (Sobel z = -0.07, p = .95), which was confirmed by the bootstrap results as the confidence interval contained zero (Task: -1.68, 0.79; Teammate: -0.88, 0.55). Thus, Hypothesis 1b was supported (main effect of condition on adaptive team performance); however, the data did not support mediation when Task and Teammate SMMs were operationalized as similarity indices between three-person intact teams and membership loss with replacement teams, thus, not supporting Hypotheses 2b-2d and 3b-c.

Table 13

Mediation: SMM Correlation, 3-person Intact & Membership Loss w/Replacement Teams

Variable	β	*SE*	*t*	*P*	*Confidence Interval* *LL 95% CI*	*UL 95% CI*
			Direct and Total Effects			
Adaptive Performance Regressed on Condition[a]	-1.77	1.26	-1.41	.17	-4.37	0.83
Task SMMs Regressed on Condition[a]	0.11	0.09	1.23	.23	-0.07	0.28
Team Interaction SMMs Regressed on Condition[a]	0.30	0.51	0.51	.62	-0.19	0.10
Teammate SMMs Regressed on Condition[a]	-0.08	0.09	-0.88	.39	-0.27	0.11
Adaptive Performance Regressed on Task SMMs, controlling for Condition[a]	-0.55	2.90	-0.19	.85	-6.56	5.46
Adaptive Performance Regressed on Team Interaction SMMs, controlling for Condition[a]	4.50	3.59	1.25	.22	-2.95	11.94
Adaptive Performance Regressed on Teammate SMMs, controlling for Condition[a]	0.29	2.62	0.11	.91	-5.15	5.72
Adaptive Performance Regressed on Condition[a], controlling for SMMs (Total Effects Model)	**-2.06**	**1.15**	**-1.79**	**.09***	**-4.43**	**0.32**
	Effect	*SE*	*z*	*P*		
			Indirect Effect and Significance Using Normal Theory			
Sobel – Task SMMs	-0.06	0.40	-0.15	.88		
Sobel – Team Interaction SMMs	-0.20	0.44	-0.46	.64		
Sobel – Teammate SMMs	-0.02	0.33	-0.07	.95		
					Bootstrap Confidence Interval	
	Effect	*Boot SE*			*LL 95% CI*	*UL 95% CI*
			Bootstrap Results for Indirect Effect			
Task SMMs	-0.06	0.55			-1.68	0.79
Team Interaction SMMs	-0.20	0.45			-2.03	0.26
Teammate SMMs	-0.02	0.34			-0.88	0.55

Note. n = 30 teams. Bootstrap sample size = 5,000. LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 3 (3-Person Intact Teams) & 5 (Membership Loss w/Replacement Teams), Controlling for Average GPA, Team Familiarity, & Role Comprehension. *p = .04 level, 1-tailed.

Results for the relative distance SMM metric, presented in Table 14, also do not support the mediation hypotheses for Task and Teammate SMMs. Task SMMs, operationalized as the Euclidean distance between team member mental models, was not significantly predicted by condition, β = -0.39, t = -0.31, p = .76, two-tailed. Condition also did not predict Teammate SMMs, β = 0.17, t = 1.04, p = .14, two-tailed. Neither of the SMM distance indices predicted Adaptive Team Performance (Task: β = -0.23, t = -1.23, p = .23, two-tailed; Teammate: β = -0.12, t = -0.08, p = .93, two-tailed). Furthermore, the two-tailed significance test assuming normal distribution revealed a non-significant effect (Sobel z = 0.15, p = .88), which was confirmed by the bootstrap results, as both the Task SMM confidence interval (-1.09, 2.55) and the Teammate SMM confidence interval (-1.19, 0.61) contained zero. Thus, Hypotheses 2b-d and 3b-c were not supported for three-person intact teams as compared to membership loss with replacement teams when SMMs were operationalized as distance between member ratings.

Table 14

Mediation: Euclidean Distance, 3-person Intact & Membership Loss w/Replacement Teams

Variable	β	*SE*	*t*	*p*	*Confidence Interval* *LL 95% CI*	*UL 95% CI*
		Direct and Total Effects				
Adaptive Performance Regressed on Condition[a]	-1.77	1.26	-1.41	.17	-4.37	0.83
Task SMMs Regressed on Condition[a]	-0.39	1.27	-0.31	.76	-3.02	2.23
Team Interaction SMMs Regressed on Condition[a]	-1.66	1.08	-1.53	.14	-3.88	0.57
Teammate SMMs Regressed on Condition[a]	0.17	0.16	1.04	.31	-0.17	0.51
Adaptive Performance Regressed on Task SMMs, controlling for Condition[a]	-0.23	0.19	-1.23	.23	-0.61	0.16
Adaptive Performance Regressed on Team Interaction SMMs, controlling for Condition[a]	-0.15	0.23	-0.688	.50	-0.62	0.31
Adaptive Performance Regressed on Teammate SMMs, controlling for Condition[a]	-0.12	1.48	-0.08	.93	-3.19	2.94
Adaptive Performance Regressed on Condition[a], controlling for SMMs (Total Effects Model)	**-2.06**	**1.15**	**-1.79**	**.09***	**-4.43**	**0.32**
	Effect	*SE*	*z*	*p*		
		Indirect Effect and Significance Using Normal Theory				
Sobel – Task SMMs	0.09	0.38	0.23	.81		
Sobel – Team Interaction SMMs	0.26	0.47	0.54	.59		
Sobel – Teammate SMMs	-0.02	0.35	-0.06	.95		
	Effect	*Boot SE*			*Bootstrap Confidence Interval* *LL 95% CI*	*UL 95% CI*
		Bootstrap Results for Indirect Effect				
Task SMMs	0.09	0.51			-1.09	2.55
Team Interaction SMMs	0.26	0.62			-0.31	3.10
Teammate SMMs	-0.02	0.41			-1.19	0.61

Note. n = 30 teams. Bootstrap sample size = 5,000. LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 3 (3-Person Intact Teams) & 5 (Membership Change Teams), Controlling for Average GPA, Team Familiarity, & Role Comprehension. *p = .04 level, 1-tailed.

Moderated Mediation Results

To test the moderated mediation hypothesized relationships, models were tested in their entirety (see original model in Figure 1 above). Although Adaptive Performance remained the overall DV of interest, Transition Processes (operationalized as information sharing) was added to analyses to determine whether levels of information sharing moderated the relationship between condition and development of SMMs. Results of these analyses are presented below, based on the type of SMM index included in the analysis as well as the two conditions under comparison, as dictated by the hypotheses.

H5a & H6 Results: Two-Person Intact vs. Membership Loss Teams

Results for Hypothesis 5a-b are presented in Table 15, which show a lack of support for this hypothesis. The Condition/Information Sharing interaction was not significant for Task SMMs ($\beta = 0.01$, $t = 0.02$, $p = .38$, two-tailed) or Team Interaction SMMs ($\beta = 0.04$, $t = 1.33$, $p = .20$, two-tailed). Furthermore, all confidence intervals for the conditional effects of condition on adaptive team performance through the various SMMs at values of the mean as well as one standard deviation above and below the mean (*M* as well as +/-*SD*) contained 0. Thus, results did not support Hypothesis 5a-b. Information Sharing did not moderate the relationship between development of Task or Team Interaction SMMs for two-person intact teams as compared to membership loss teams.

Table 15

Moderated Mediation: SMMs Correlation, 2-person Intact & Membership Loss Teams

					Confidence Interval	
Predictor	β	*SE*	*t*	*p*	*LL 95% CI*	*UL 95% CI*
Task Shared Mental Model Correlation						
Constant	3.07	1.13	2.73	.01	0.74	5.41
Condition[a]	-0.11	0.24	-0.44	.66	-0.61	0.40
IS	0.01	0.02	0.24	.81	-0.04	0.05
IS x Condition[a]	0.01	0.03	0.21	.83	-0.05	0.06
Team Interaction Shared Mental Model Correlation						
Constant	-1.67	1.18	-1.42	.17	-4.11	0.78
Condition[a]	-0.39	0.26	-1.53	.14	-0.92	0.14
IS	-0.02	0.02	-1.05	.31	-0.07	0.02
IS x Condition[a]	0.04	0.03	1.33	.20	-0.02	0.10
Teammate Shared Mental Model Correlation						
Constant	-2.29	1.21	-1.89	.07	-4.80	0.22
Condition[a]	-0.27	0.26	-1.04	.31	-0.82	0.27
IS	0.02	0.02	0.93	.37	-0.03	0.07
IS x Condition[a]	-0.01	0.03	-0.48	.63	-0.08	0.05
Adaptive Team Performance						
Constant	3.42	18.15	0.19	.85	-34.32	41.17
Task SMMs	-0.50	2.64	-0.19	.85	-6.00	5.00
Team Interaction SMMs	-2.29	2.34	-0.98	.34	-7.16	2.59
Teammate SMMs	-1.65	2.50	-0.66	.52	-6.85	3.54
Condition[a b]	0.33	1.49	0.22	.83	-2.77	3.42
					Confidence Interval	
IS Value	*Effect*	*SE*			*LL 95% CI*	*UL 95% CI*
Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing						
-1 *SD* (3.16)	0.04	0.72			-1.03	1.86
M (8.17)	0.03	0.43			-0.56	1.28
+1 *SD* (13.17)	0.02	.66			-1.12	1.52

Conditional Indirect Effect of Condition on Adaptive Performance via Team Interaction SMMs at Values of Information Sharing				
-1 *SD* (3.16)	0.61	1.11	-0.68	4.46
M (8.17)	0.18	0.63	-0.42	2.74
+1 *SD* (13.17)	-0.26	0.98	-3.82	0.80
Conditional Indirect Effect of Condition on Adaptive Performance via Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.01	0.32	-0.70	0.29
M (8.17)	-0.01	0.23	-0.49	0.42
+1 *SD* (13.17)	-0.01	0.29	-0.69	0.59

Note. n = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] =Conditions 2 (2-person Intact Teams) & 4 (Membership Loss Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Average GPA, APGO, Tolerance for Ambiguity, & Role Comprehension.

When operationalized as the Euclidean distance between team member ratings, there is, again, no support for moderation (see Table 16). Although condition was found to be a significant predictor of Team Interaction SMMs, β = 5.22, $t = 1.38$, $p = .04$, one-tailed (teams who experienced membership loss had greater distance in their Team Interaction SMMs), the Condition/Information Sharing interaction was not significant for Task (β = 0.07, $t = 0.14$, $p = .89$, two-tailed) or Team Interaction (β = -0.16, $t = -0.48$, $p = .64$, two-tailed) SMMs. Each confidence interval depicting the indirect effect of condition on adaptive performance through the various SMMs contained 0. Therefore, transition processes (i.e., information sharing) did not moderate the relationship between Condition (two-person intact teams as compared to membership loss teams) and Task (H5a) or Team Interaction (H5b) SMMs.

Table 16

Moderated Mediation: SMMs Euclidean Distance, 2-person Intact & Membership Loss Teams

Predictor	β	*SE*	*t*	*p*	*Confidence Interval* *LL 95% CI*	*UL 95% CI*
			Task Shared Mental Model Euclidean Distance			
Constant	39.76	21.10	1.88	.07	-4.00	83.52
Condition[a]	2.72	4.56	0.60	.56	-6.75	12.19
IS	-0.06	0.40	-0.14	.89	-0.88	0.77
IS x Condition[a]	0.07	0.51	0.14	.89	-1.00	1.14
			Team Interaction Shared Mental Model Euclidean Distance			
Constant	54.75	13.21	4.15	.0004	27.36	82.14
Condition[a]	**5.22**	**2.86**	**1.83**	**.08***	**-0.70**	**11.15**
IS	0.07	0.25	0.28	.79	-0.45	0.58
IS x Condition[a]	-0.16	0.32	-0.48	.64	-0.82	0.51
			Teammate Shared Mental Model Euclidean Distance			
Constant	1.48	2.27	0.65	.52	-3.23	6.19
Condition[a]	-0.41	0.49	-0.84	.41	-1.43	0.61
IS	-0.02	0.04	-0.52	.61	-0.11	0.07
IS x Condition[a]	0.07	0.06	1.24	.23	-0.05	0.18
			Adaptive Team Performance			
Constant	13.35	17.89	0.75	.46	-23.86	50.57
Task SMMs	-0.01	0.15	-0.04	.97	-0.31	0.30
Team Interaction SMMs	-0.09	0.23	-0.37	.71	-0.56	0.39
Teammate SMMs	0.27	1.29	0.21	.84	-2.41	2.95
Condition[a b]	1.34	1.52	0.88	.39	-1.83	4.51
IS Value	*Effect*	*SE*			*Confidence Interval* *LL 95% CI*	*UL 95% CI*
			Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing			
-1 *SD* (3.16)	-0.02	1.01			-2.07	1.93
M (8.17)	-0.02	0.84			-1.88	1.62
+1 *SD* (13.17)	-0.02	0.97			-2.56	1.65

Conditional Indirect Effect of Condition on Adaptive Performance via Team Interaction SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.41	1.19	-3.37	1.51
M (8.17)	-0.34	0.97	-2.78	1.18
+1 *SD* (13.17)	-0.27	0.96	-3.14	0.97
Conditional Indirect Effect of Condition on Adaptive Performance via Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.05	0.79	-1.97	1.22
M (8.17)	0.04	0.60	-0.78	2.17
+1 *SD* (13.17)	0.13	1.17	-1.54	3.96

Note. n = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] =Conditions 2 (2-person Intact Teams) & 4 (Membership Loss Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Average GPA, APGO, Tolerance for Ambiguity, & Role Comprehension. *p = .04, 1-tailed.

H5b & H7 Results: Three-Person Intact vs. Membership Loss w/Replacement Teams

Transition Processes, operationalized as Information Sharing, was also predicted to moderate the relationship between Condition (three-person intact team) and Task and Teammate SMMs. Table 17 provides the results with SMMs operationalized using the similarity index, which show a lack of support for these hypotheses. The Condition/Information Sharing interaction was not significant for either Task (β = 0.000, t = 0.03, p = .98, two-tailed) or Teammate (β = 0.004, t = -0.78, p = .44, two-tailed) SMMs. Furthermore, all confidence intervals for the conditional indirect effect of condition on adaptive performance through the various SMMs contained 0, thus, not supporting Hypotheses 5b or 7.

Table 17

Moderated Mediation: SMMs Corr., 3-Person Intact & Membership Loss w/Replacement Teams

					Confidence Interval	
Predictor	β	*SE*	*t*	*p*	*LL 95% CI*	*UL 95% CI*
			Task Shared Mental Model Correlation			
Constant	0.33	0.68	0.48	.64	-1.08	1.73
Condition[a]	0.11	0.16	0.66	.52	-0.23	0.44
IS	-0.002	0.01	-0.20	.85	-0.02	0.02
IS x Condition[a]	0.000	0.01	0.03	.98	-0.03	0.03
			Team Interaction Shared Mental Model Correlation			
Constant	0.36	0.56	0.65	.52	-0.79	1.52
Condition[a]	-0.07	0.13	-0.53	.60	-0.35	0.21
IS	-0.01	0.01	-0.58	.57	-0.02	0.01
IS x Condition[a]	0.004	0.01	0.30	.76	-0.02	0.01
			Teammate Shared Mental Model Correlation			
Constant	-0.10	0.73	-0.14	.89	-1.62	1.42
Condition[a]	-0.11	0.18	-0.63	.54	-0.47	0.25
IS	-0.01	0.02	0.26	.80	-0.03	0.04
IS x Condition[a]	0.004	0.01	0.78	.44	-0.01	0.02
			Adaptive Team Performance			
Constant	-6.51	8.60	-0.76	.46	-24.35	11.33
Task SMMs	-0.55	2.90	-0.19	.85	-6.56	5.46
Team Interaction SMMs	4.50	3.59	1.25	.22	-2.95	11.94
Teammate SMMs	0.29	2.62	0.11	.91	-5.15	5.72
Condition[a b]	-1.77	1.26	-1.41	.17	-4/37	0.83

			Confidence Interval	
IS Value	*Effect*	*SE*	*LL 95% CI*	*UL 95% CI*
		Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing		
-1 *SD* (3.16)	-0.06	0.58	-1.86	0.74
M (8.17)	-0.06	0.55	-1.59	0.77
+1 *SD* (13.17)	-0.06	0.76	-2.01	0.99

Conditional Indirect Effect of Condition on Adaptive Performance via Team Interaction SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.27	0.73	-2.75	0.59
M (8.17)	-0.16	0.47	-1.87	0.33
+1 *SD* (13.17)	-0.05	0.73	-1.87	1.05
Conditional Indirect Effect of Condition on Adaptive Performance via Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.03	0.43	-1.14	0.71
M (8.17)	-0.02	0.37	-0.93	0.55
+1 *SD* (13.17)	-0.01	0.54	-1.29	0.85

Note. n = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] =Conditions 3 (3-person Intact Teams) & 5 (Membership Loss w/Replacement Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Average GPA, Team Familiarity, & Role Comprehension.

Analyses were also conducted with the Euclidean distance SMM index (see Table 18), revealing no statistically significant interaction between Condition/Information Sharing for Task (β = -0.03, t = -0.17, p = .87) or Teammate SMMs (β = -0.03, t = -0.17, p = .87). Furthermore, when considering the indirect effect of condition on adaptive performance through the various SMMs, each confidence interval contained 0. Thus, there is no support for Hypotheses 5b or 7. Notice, however, that the relationship between condition and adaptive performance remains significant in this model as well, (β = -2.38, t = -1.93, p = .04, one-tailed), adding support to H1b that condition significantly predicts adaptive team performance such that intact teams have higher adaptive performance than membership loss with replacement teams.

Table 18

Moderated Med.: SMMs Euc. Dist., 3-Person Intact & Membership Loss w/Replacement Teams

					Confidence Interval	
Predictor	β	*SE*	*t*	*p*	*LL 95% CI*	*UL 95% CI*
			Task Shared Mental Model Euclidean Distance			
Constant	16.04	10.11	1.59	.13	-4.87	36.95
Condition[a]	0.07	2.42	0.03	.98	-4.92	5.06
IS	-0.02	0.16	-0.12	.91	-0.35	0.31
IS x Condition[a]	-0.04	0.21	-0.18	.86	-0.47	0.40
			Team Interaction Shared Mental Model Euclidean Distance			
Constant	16.22	8.51	1.91	.07	-1.39	33.84
Condition[a]	-2.57	2.03	-1.27	.22	-6.78	1.63
IS	-0.09	0.13	-0.67	.51	-0.37	0.19
IS x Condition[a]	0.10	0.18	0.59	.56	-0.26	0.47
			Teammate Shared Mental Model Euclidean Distance			
Constant	2.72	1.26	2.17	.04	0.12	5.32
Condition[a]	0.01	0.30	0.03	.98	-0.61	0.63
IS	0.01	0.02	0.32	0.75	-0.03	0.05
IS x Condition[a]	0.01	0.03	0.51	0.62	-0.04	0.07
			Adaptive Team Performance			
Constant	0.59	10.56	0.06	.96	-21.32	22.50
Task SMMs	-0.23	0.19	-1.23	.24	-0.61	0.16
Team Interaction SMMs	-0.15	0.23	-0.68	.50	-0.62	0.31
Teammate SMMs	-0.12	1.50	-0.08	.93	-3.19	2.94
Condition[a b]	**-2.38**	**1.23**	**-1.93**	**.07***	**-4.94**	**0.18**
					Confidence Interval	
IS Value	*Effect*	*SE*			*LL 95% CI*	*UL 95% CI*
			Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing			
-1 *SD* (3.16)	0.01	0.76			-1.33	2.08
M (8.17)	0.07	0.55			-0.78	1.61
+1 *SD* (13.17)	0.13	0.82			-1.01	2.47

Conditional Indirect Effect of Condition on Adaptive Performance via Team Interaction SMMs at Values of Information Sharing				
-1 *SD* (3.16)	0.34	0.80	-0.45	3.86
M (8.17)	0.23	0.59	-0.30	2.69
+1 *SD* (13.17)	0.12	0.70	-0.68	2.09
Conditional Indirect Effect of Condition on Adaptive Performance via Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.16)	-0.01	0.43	-0.95	0.79
M (8.17)	-0.02	0.39	-1.10	0.56
+1 *SD* (13.17)	-0.03	0.57	-1.53	0.87

Note. n = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] =Conditions 3 (3-person Intact Teams) & 5 (Membership Loss w/Replacement Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Average GPA, Team Familiarity, & Role Comprehension. *p = .04, 1-tailed.

Exploratory Analyses

As noted above, Teammate SMMs were operationalized using a personality assessment, comparing self-ratings to other-ratings of self (see Table 4 for variable operationalizations). In this particular study, hypothesis testing was conducted using the Big 5 personality assessment to determine whether team members in various membership fluidity conditions would develop more similar SMMs regarding each other's personality characteristics on the five personality facets of openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism. The task used in this study was a customer service based task. The Waiting Room Staffer had to interact with patients and coworkers in a video-based simulation. The Records and Claims Staffers (or Staffer, in the two-person intact team condition) had to watch the simulation to glean particular patient information as well as keep track of patient files and interact with the "hospital staff" (i.e., experimenter) who provided additional patient details via a chat function. This provides limited opportunities to demonstrate certain personality traits assessed from this measure. For example, it would be difficult for the Records Staffer to demonstrate openness to experience when his/her job is to record patient and staff information. Without any demonstration of cues that suggest high or low openness to experience, the other team members would have little insight into that particular personality trait. By using an overall measure of personality to test the Teammate SMM hypotheses, these lack of cues associated with particular traits could lead to attenuation of correlations (similarity index) and inflated Euclidean distances (distance index) for this particular SMM. Thus, exploratory analyses were conducted, considering each facet as a separate variable. Analyses were run together for the entire model (moderated mediation) including Task SMMs as that particular SMM was hypothesized to also mediate the relationship between three-person intact teams and membership loss with replacement teams. Results are reported below for both types of indices.

Teammate SMM Facets: Similarity Index

Table 19 provides results of the exploratory facet analyses for the similarity index. The only facet that was predicted by condition was the Agreeableness facet, $\beta = -0.21$, $t = -1.97$, $p = .05$, two-tailed. Essentially, three-person intact teams had more similar Teammate MMs regarding the facet of agreeableness than membership loss with replacement teams. Analyses were also conducted to determine whether any of the facet SMMs predicted adaptive performance. The Neuroticism facet of Teammate SMMs was the only facet to significantly predict adaptive team performance, $\beta = 4.57$, $t = 1.99$, $p = .05$, two-tailed. Teams who were able to more correctly identify members' levels of neuroticism, and thus develop more similar MMs regarding neuroticism traits in fellow teammates, were able to perform better during Time II Performance than Time I.

Table 19

Moderated Mediation: Teammate SMM Facets Correlations, Exploratory Analyses

Predictor	β	*SE*	*t*	*p*	*Confidence Interval*	
					LL 95% CI	*UL 95% CI*
Task Shared Mental Model Correlation						
Constant	0.33	0.11	3.05	.01	0.11	0.56
Condition[a]	0.11	0.16	0.74	.47	-0.21	0.43
IS	-0.001	0.01	-0.07	.94	-0.02	0.02
IS x Condition[a]	-0.001	0.01	-0.08	.94	-0.03	0.03
Team Familiarity	-0.001	0.01	-0.21	.84	-0.01	0.01
Openness Teammate Shared Mental Model Correlation						
Constant	0.12	0.08	1.61	.12	-0.03	0.28
Condition[a]	-0.08	0.11	-0.72	.48	-0.30	0.14
IS	-0.01	0.01	-1.03	.31	-0.02	0.01
IS x Condition[a]	0.01	0.01	1.09	.29	-0.01	0.03
Team Familiarity	-0.003	0.003	-1.03	.31	-0.01	0.003
Conscientiousness Teammate Shared Mental Model Correlation						
Constant	-0.03	0.11	-0.28	.78	-0.25	0.19
Condition[a]	0.02	0.15	0.11	.91	-0.30	0.33
IS	-0.01	0.01	-0.72	.48	-0.03	0.01
IS x Condition[a]	0.02	0.01	1.37	.18	-0.01	0.04
Team Familiarity	0.001	0.01	0.26	.80	-0.01	0.01
Extroversion Teammate Shared Mental Model Correlation						
Constant	0.26	0.13	1.91	.07	-0.02	0.53
Condition[a]	-0.27	0.19	-1.40	.18	-0.66	0.13
IS	-0.01	0.01	-0.77	.45	-0.03	0.02
IS x Condition[a]	0.02	0.03	1.20	.24	-0.01	0.05
Team Familiarity	0.001	0.01	0.09	.93	-0.01	0.01
Agreeableness Teammate Shared Mental Model Correlation						
Constant	0.16	0.08	2.04	.05	-0.001	0.31
Condition[a]	**-0.21**	**0.11**	**-1.97**	**.05**	**-0.43**	**0.01**
IS	-0.003	0.01	-0.58	.57	-0.02	0.01

IS x Condition[a]	0.01	0.01	0.64	.53	-0.01	0.02
Team Familiarity	0.01	0.003	1.52	.14	-0.002	0.01
Neuroticism Teammate Shared Mental Model Correlation						
Constant	0.19	0.13	1.43	.16	-0.08	0.46
Condition[a]	-0.12	0.18	-0.64	.53	-0.50	0.26
IS	-0.01	0.01	-0.99	.33	-0.04	0.01
IS x Condition[a]	0.02	0.02	1.24	.23	-0.01	0.05
Team Familiarity	-0.002	0.01	-0.27	.79	-0.01	0.01
Adaptive Team Performance						
Constant	1.94	1.06	2.83	.08	-0.26	4.14
Task SMM	2.38	2.71	0.88	.39	-3.26	8.01
Teammate O SMM	-3.02	3.99	-0.76	.46	-11.31	5.27
Teammate C SMM	-5.15	2.87	-1.80	.09	-11.12	0.82
Teammate E SMM	-2.19	2.08	-1.05	.31	-6.52	2.15
Teammate A SMM	-3.73	4.46	-0.84	.41	-13.01	5.56
Teammate N SMM	**4.57**	**2.29**	**1.99**	**.05**	**-0.20**	**9.34**
Condition[a b]	-1.99	1.52	-1.31	.21	-5.15	1.18
Team Familiarity	0.04	0.06	0.70	.49	-0.08	0.17
					Confidence Interval	
IS Value	*Effect*	*SE*			*LL 95% CI*	*UL 95% CI*
Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing						
-1 *SD* (3.46)	0.26	0.60			-0.45	2.31
M (10.30)	0.25	0.57			-0.33	2.33
+1 *SD* (17.14)	0.23	0.85			-0.47	3.22
Conditional Indirect Effect of Condition on Adaptive Performance via Openness Teammate SMMs at Values of Information Sharing						
-1 *SD* (3.46)	0.13	0.50			-0.36	2.18
M (10.30)	-0.07	0.34			-1.08	0.36
+1 *SD* (17.14)	-0.27	0.53			-2.32	0.29
Conditional Indirect Effect of Condition on Adaptive Performance via Conscientiousness Teammate SMMs at Values of Information Sharing						
-1 *SD* (3.46)	-0.40	0.73			-2.70	0.63

M (10.30)	-1.02	0.72	-3.18	-0.003
+1 *SD* (17.14)	-1.64	1.14	-4.53	0.07
Conditional Indirect Effect of Condition on Adaptive Performance via Extroversion Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	0.44	0.61	-0.36	2.38
M (10.30)	0.15	0.45	-0.30	1.73
+1 *SD* (17.14)	-0.14	0.65	-1.92	0.57
Conditional Indirect Effect of Condition on Adaptive Performance via Agreeableness Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	0.71	1.01	-0.89	3.16
M (10.30)	0.57	0.83	-0.82	2.54
+1 *SD* (17.14)	0.42	0.86	-0.39	2.91
Conditional Indirect Effect of Condition on Adaptive Performance via Neuroticism Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	-0.24	0.76	-2.70	0.70
M (10.30)	0.36	0.60	-0.31	2.46
+1 *SD* (17.14)	0.95	1.11	-0.09	5.38

Note. n = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 3 (3-Person Intact Teams) & 5 (Membership Loss w/Replacement Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Team Familiarity.

Teammate SMM Facets: Distance Index

Table 20 provides results of the exploratory facet analyses for the distance index. None of the facets were significantly predicted by condition when operationalized using the Euclidean distance. However, the both the Openness facet ($\beta = 3.51$, $t = 2.37$, $p = .03$, two-tailed) and the Agreeableness facet ($\beta = -3.30$, $t = -2.65$, $p = .02$, two-tailed) of Teammate SMMs significantly predicted adaptive team performance. When considering the distance scores, negative beta weights suggest that teams who had less distance in their ratings (i.e., developed more similar MMs), were able to perform better during Time II Performance than Time I. Therefore, teams who had more similar SMMs regarding the Agreeableness facet of Teammate SMMs performed better at Time II Performance than at Time I.

Table 20

Moderated Mediation: Teammate SMM Facets Euc. Dist., Exploratory Analyses

Predictor	β	*SE*	*t*	*p*	*Confidence Interval*	
					LL 95% CI	*UL 95% CI*
Task Shared Mental Model Euclidean Distance						
Constant	12.04	1.63	7.39	.000	8.68	15.40
Condition[a]	0.06	2.31	0.03	.98	-4.70	4.81
IS	-0.02	0.14	-0.15	.88	-0.32	0.27
IS x Condition[a]	-0.04	0.19	-0.20	.85	-0.44	0.36
Team Familiarity	0.01	0.07	0.16	.88	-0.13	0.15
Openness Teammate Shared Mental Model Euclidian Distance						
Constant	2.77	0.23	12.03	.000	2.29	3.24
Condition[a]	-0.03	0.33	-0.09	.93	-0.70	0.64
IS	-0.02	0.02	-0.81	.42	-0.06	0.03
IS x Condition[a]	-0.02	0.03	-0.53	.60	-0.07	0.04
Team Familiarity	0.01	0.01	1.29	.21	-0.01	0.03
Conscientiousness Teammate Shared Mental Model Euclidian Distance						
Constant	2.52	0.24	10.62	.000	2.03	3.01
Condition[a]	0.47	0.34	1.38	.18	-0.23	1.16
IS	0.02	0.02	0.99	.33	-0.02	0.06
IS x Condition[a]	-0.03	0.02	-1.10	.28	-0.09	0.03
Team Familiarity	-0.01	0.01	-0.95	.35	-0.03	0.01
Extroversion Teammate Shared Mental Model Euclidian Distance						
Constant	2.32	0.23	10.18	.000	1.85	2.79
Condition[a]	0.42	0.32	1.29	.21	-0.25	1.08
IS	0.02	0.02	0.73	.47	-0.03	0.06
IS x Condition[a]	0.02	0.02	-1.53	.14	-0.10	0.01
Team Familiarity	-0.01	0.01	-0.53	.60	-0.03	0.02
Agreeableness Teammate Shared Mental Model Euclidian Distance						

Constant	1.93	0.29	6.71	.000	1.34	2.52
Condition[a]	0.57	0.41	1.39	.18	-0.28	1.40
IS	0.02	0.03	1.01	.33	-0.03	0.08
IS x Condition[a]	-0.04	0.03	-1.16	.26	-0.11	0.03
Team Familiarity	0.02	0.01	1.22	.23	-0.01	0.04
Neuroticism Teammate Shared Mental Model Euclidian Distance						
Constant	2.94	0.31	9.60	.000	2.31	3.57
Condition[a]	-0.43	0.43	-0.99	.33	-1.32	0.46
IS	0.002	0.03	0.73	.47	-0.04	0.08
IS x Condition[a]	0.002	0.04	0.06	.95	-0.07	0.08
Team Familiarity	-0.002	0.01	-0.14	.89	-0.03	0.02
Adaptive Team Performance						
Constant	8.09	4.42	1.83	.08	-1.11	17.29
Task SMM	-0.33	0.18	-1.80	.09	-0.71	0.05
Teammate O SMM	**3.51**	**1.48**	**2.37**	**.03**	**0.43**	**6.59**
Teammate C SMM	0.20	1.40	0.15	.89	-2.71	3.12
Teammate E SMM	-0.64	1.29	-0.49	.63	-3.33	2.05
Teammate A SMM	**-3.30**	**1.25**	**-2.65**	**.02**	**-5.89**	**-0.72**
Teammate N SMM	-1.09	0.94	-1.16	.26	-3.03	0.86
Condition[a b]	-0.97	1.22	-0.80	.44	-3.51	1.57
Team Familiarity	0.01	0.06	0.25	.81	-0.11	0.14

					Confidence Interval	
IS Value	*Effect*	*SE*			*LL 95% CI*	*UL 95% CI*
Conditional Indirect Effect of Condition on Adaptive Performance via Task SMMs at Values of Information Sharing						
-1 *SD* (3.46)	0.02	0.89			-1.48	2.33
M (10.30)	0.11	0.59			-0.79	1.83
+1 *SD* (17.14)	0.19	0.76			-0.86	2.55
Conditional Indirect Effect of Condition on Adaptive Performance via Openness Teammate SMMs at Values of Information Sharing						
-1 *SD* (3.46)	-0.28	1.23			-3.64	1.64
M (10.30)	-0.63	0.86			-2.91	0.58
+1 *SD* (17.14)	-0.98	1.13			-4.14	0.53

Conditional Indirect Effect of Condition on Adaptive Performance via Conscientiousness Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	0.07	0.79	-1.28	2.27
M (10.30)	0.03	0.45	-0.66	1.16
+1 *SD* (17.14)	-0.01	0.48	-1.37	0.49
Conditional Indirect Effect of Condition on Adaptive Performance via Extroversion Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	-0.18	0.58	-2.26	0.50
M (10.30)	-0.01	0.46	-0.71	1.09
+1 *SD* (17.14)	0.19	0.95	-0.60	4.17
Conditional Indirect Effect of Condition on Adaptive Performance via Agreeableness Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	-1.41	1.60	-6.40	0.69
M (10.30)	-0.52	0.95	-3.47	0.84
+1 *SD* (17.14)	0.38	1.37	-1.72	3.80
Conditional Indirect Effect of Condition on Adaptive Performance via Neuroticism Teammate SMMs at Values of Information Sharing				
-1 *SD* (3.46)	0.46	0.71	-0.34	2.42
M (10.30)	0.44	0.61	-0.17	2.29
+1 *SD* (17.14)	0.43	0.84	-0.32	3.12

Note. *n* = 30 teams. Values for quantitative moderators are the mean and plus/minus one *SD* from mean. Bootstrap sample size = 5,000. IS = Information Shared; SMM = Shared Mental Models; LL = lower limit; CI = confidence interval; UL = upper limit. Condition[a] = Conditions 3 (3-Person Intact Teams) & 5 (Membership Loss w/Replacement Teams). Condition[b] = this value represents the direct effect of Condition on Adaptive Performance, controlling for Team Familiarity.

CHAPTER FIVE: DISCUSSION

The hypotheses in this study essentially described a moderated mediation model, derived from theory, to explain one possible mechanism that enables teams to adapt: shared mental models. It was hypothesized that teams in the experimental conditions (i.e., membership loss or loss with replacement), would not develop the same level of sharedness in mental models as teams who did not experience any membership loss or loss with replacement (i.e., control conditions – intact teams). Furthermore, membership fluidity was expected to negatively influence adaptive performance but that relationship was predicted to be partially mediated by the lack of sharedness in mental models. However, it was also predicted that information sharing would moderate the relationship between condition and sharedness of mental models such that if teams engaged in high levels of information sharing (regardless of condition), they would develop more similar mental models than teams who did not share as much information.

Results suggest that three-person intact teams demonstrated greater adaptive performance than teams who experienced membership loss with replacement. Furthermore, two-person intact teams developed more similar task and team interaction SMMs than teams who lost a member when SMMs were indexed as a Euclidean distance score. Contrary to predictions, there were no differences in the level of sharedness regarding task or teammate SMMs for three-person intact teams as compared to membership loss with replacement teams. However, when teammate SMMs were operationalized as the individual personality facets (i.e., the Big 5 – openness to experience, conscientiousness, extroversion, agreeableness, and neuroticism) in exploratory analyses, three-person intact teams did develop more similar SMMs regarding the agreeableness facet (similarity index) than membership loss with replacement teams. Additionally, when operationalized as Euclidean distance, the Agreeableness facet significantly predicted adaptive team performance—

specifically, the smaller the distance (i.e., more similar the MMs), the greater the adaptive performance in teams. When operationalized as the similarity index, the neuroticism facet significantly predicted adaptive team performance such that the more similar the SMMs, the greater the adaptive performance in teams. Table 21 contains a summary of the hypothesis testing results, which is followed by the resulting model that was supported by hypothesis testing and exploratory analyses (see Figure 6).

Table 21

Summary of Hypothesis Testing

Hypotheses		Supported or Not Supported
H1a	Two-person intact teams will demonstrate greater adaptive performance than will two-person membership loss teams.	Not Supported
H1b	Three-person intact teams will demonstrate greater adaptive performance than will three-person membership loss with replacement teams.	Supported
H2a	Two-person intact teams will develop more similar Task MMs than two-person membership loss teams.	Supported (Euclidean Distance)
H2b	Three-person intact teams will develop more similar Task MMs than three-person membership loss with replacement teams.	Not Supported
H2c	Task MMs similarity will be positively related to adaptive performance.	Not Supported
H2d	Task SMMs will partially mediate the relationship between membership fluidity and adaptive team performance.	Not Supported
H3a	Two-person intact teams will develop more similar Team Interaction MMs than two-person membership loss teams.	Supported (Euclidean distance)
H3b	Team Interaction MMs similarity will be positively related to adaptive performance.	Not Supported
H3c	Team Interaction SMMs will partially mediate the impact of membership loss and adaptive team performance for two-person teams.	Not supported
H4a	Three-person intact teams will develop more similar Teammate MMs than three-person membership loss with replacement teams.	Not Supported (Exploratory analyses suggest Membership Fluidity predicts sharedness of Teammate MM when operationalized as the Agreeableness facet – similarity index)
H4b	Teammate MM similarity will be positively related to adaptive performance.	Not supported (Exploratory analyses suggest that the Neuroticism facet – similarity index and the Agreeableness facet –

		Euclidean distance of Teammate SMMs significantly predict Adaptive Team Performance)
H4c	Teammate SMMs will partially mediate the impact of membership replacement and adaptive team performance for three-person teams.	Not Supported
H5a	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.	Not Supported
H5b	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Task SMMs. The differences in Task MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.	Not Supported
H6	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Team Interaction SMMs. The differences in Team Interaction MM similarity among intact teams and membership loss teams will be lessened by high levels of information sharing during transition periods.	Not Supported
H7	Transition processes, operationalized as information sharing, will moderate the relationship between membership fluidity and Teammate SMMs. The differences in Teammate MM similarity among intact teams and membership loss with replacement teams will be lessened by high levels of information sharing during transition periods.	Not Supported

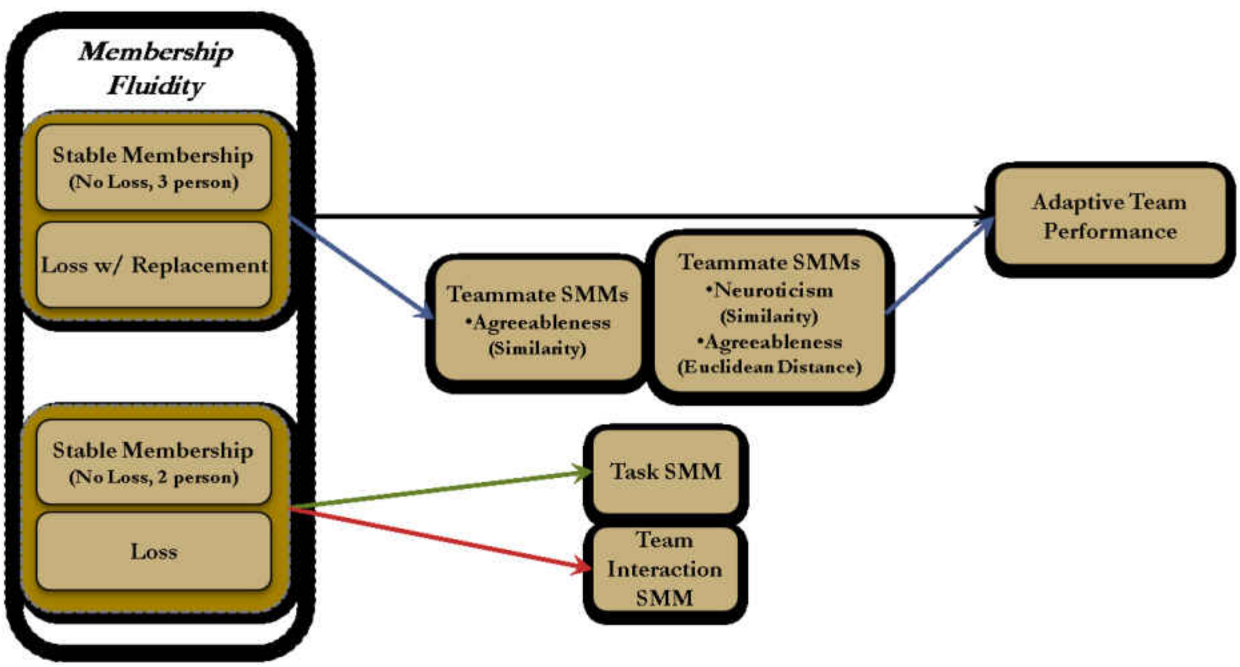

Figure 6. Supported Model

Implications

Considering all analyses together, results suggest that membership fluidity negatively influenced the development of shared mental models among teammates. Furthermore, this study provides additional evidence that teammate and team interaction mental models, which are typically not examined together in team studies, are differentially influenced by membership fluidity and differentially predict outcomes like adaptive team performance. Table 22 provides more specific details of the analyses (both hypothesis testing and exploratory analyses) that led to this interpretation.

Table 22

Summary of Significant Findings

Analysis or Hypothesis	Details of Significant Findings
	Hypothesis Testing
H1b	Three-person intact teams demonstrated greater adaptive performance than membership loss with replacement teams. The intact teams had greater gains in performance between Time I and Time II than the membership loss with replacement teams.
H2a	Two-person intact teams developed more similar Task MMs than membership loss teams. When operationalized using the distance index, intact teams has less distance among member mental models regarding the task than teams that experienced membership loss.
H3a	Two-person intact teams developed more similar Team Interaction MMs than membership loss teams. When operationalized using the distance index, intact teams has less distance among member mental models regarding how team members should coordinate than teams that experienced membership loss.
	Exploratory Analyses
H4a	Three-person intact teams developed more similar Teammate SMMs than membership loss with replacement teams when operationalized as the Agreeableness facet using the similarity index. Specifically, intact teams had more similar SMMs regarding member levels of agreeableness than membership loss with replacement teams.
H4b	Teammate SMMs predicted adaptive team performance when SMMs were operationalized as both the neuroticism facet (using the similarity index) and the Agreeableness facet using the Euclidean distance. Specifically, the more similar team members SMMs regarding levels of neuroticism were, the greater the adaptive performance. Also, the less distance among member SMMs regarding levels of agreeableness, the greater the adaptive team performance.

Theoretical Implications

Theoretically, this research extends current understanding of team adaptation by moving beyond a change in task complexity or one type of change in team configuration to investigate team member loss as well as team member loss with replacement—more accurately representing the dynamic flow of individuals among teams common in organizations today. Although some research has focused on the impact of fluid workgroups (DeRue et al., 2008; Harrison, McKinnon, Wu, & Chow, 2000), research has yet to address specific process effects of losing a team member without replacement. In fact, science is just beginning to consider membership fluidity as a potential issue in process loss. Early work on team adaptation with regard to membership change has largely been theoretical. Providing empirical evidence regarding process loss (as was demonstrated in this study with the membership loss with replacement teams compared to the three-person intact teams) helps move the field forward in terms of synthesizing existing assumptions into meaningful theory.

This study found a direct negative influence of membership loss with replacement on adaptive team performance. Although results did not support SMMs mediating the relationship between the various condition and performance in this study, membership fluidity did negatively influence development of task, team interaction, and teammate SMMs. With regard to task SMMs, this may be due to the fact that they do not exert a direct main effect on adaptive performance, but rather exert an effect through team process, as evidenced by Mathieu and colleagues (2000) who demonstrated that only team SMMs had a direct impact on performance. However, Smith-Jentsch and colleagues (Smith-Jentsch et al., 2005) also found that neither task nor team SMMs had a direct effect on performance, but rather the interaction of the two positively influenced tower safety and efficiency in air traffic control teams. These findings may explain why task, team interaction nor overall teammate SMMs exerted a direct effect on performance in this study as well.

Although none of the hypothesized SMMs influenced adaptive performance, when operationalized at the facet level for agreeableness and neuroticism, teammate SMMs significantly predicted adaptive team performance. Research within the team domain rarely considers multiple types of Team SMMs within a single study. Especially since Mathieu and colleagues (2000) suggested that the four types of SMMs outlined by Cannon-Bowers and colleagues (1993) ultimately depict two major content domains of task and team SMMs. A review of team literature noted that very few studies have conceptualized more than one dimension of SMMs (Mathieu et al., 2008). When more than one dimension has been studied, researchers almost unanimously focus on task and team SMMs, specifically ignoring *teammate* SMMs and instead focusing on *team interaction* SMMs. Besides work from Smith-Jentsch and colleagues (2001), the majority of research that has considered the degree to which team member preferences are known and shared has typically resided in the transactive memory system literature. Transactive memory systems (TMS) is considered to be the collection of individually held information and the knowledge regarding the distribution of that information among team members (Wegner, 1986). In fact, the results of this study are consistent with findings by Lewis and colleagues (2007) who found differences in TMS between intact teams and reconstituted teams. Intact teams tend to learn more quickly than teams with membership changes (Edmondson, Winslow, Bohmer, & Pisano, 2003).

Indeed, in this study, intact teams (either two-person as compared to membership loss teams or three-person as compared to membership loss with replacement teams) had significantly higher levels of all three types of SMMs measured in this effort (i.e., task, team interaction, and teammate). However, those differences did not reside with one particular type of intact teams compared to one particular type of membership fluidity. There were differential findings based on whether teams experienced membership loss or membership loss with replacement and whether the intact had two or three members. This suggests that researchers who study only one type of SMM are not capturing the complete nuances of team cognition.

Furthermore, the findings from the exploratory analyses suggest that multiple dimensions of SMMs—particularly teammate SMMs—need to be included in studies as there are distinct differences in the pattern of results. The levels of sharedness regarding member agreeableness and neuroticism predicted adaptive performance. This particular task was a customer service task, and the hospital staff and patients were scripted specifically to be challenging to work with. In such instances, there are many opportunities for teammates to observe levels of agreeableness. Consider the member who is interacting with the simulation (Waiting Room Staffer) who specifically sees all patients and hospital staffers, some of whom are difficult to deal with. It is very easy to determine one's level of agreeableness when observing someone interacting with the simulation. During the second action phase, members could leverage such information to alter how they interact with that person (be more candid for highly agreeable individuals and be more patient with those lower on agreeableness). This change in how members approach their teammates helps everyone gain additional information and thus, could improve performance.

Additionally, the performance measures were timed and a performance reward was offered for the highest-ranking teams. Therefore, the measures focused on both speed and accuracy. This provides many opportunities to observe levels of neuroticism as well. Imagine there is less than one minute left, and a team member shouts out, "Hurry up, guys – we're not gonna get done and were lose out on the money!" When asked for input, that same member is flustered and cannot contribute. This provides keen insight into that team member's level of neuroticism. During the next performance episode, effective team members would elicit information from that person first, to avoid having him/her get flustered towards the end of the time period or perseverate over the information while waiting to contribute, resulting in a member who had confused the details and thus, could negatively influence team performance.

These particular findings suggest that adaptation theory should specifically discuss how various types of SMMs (and their corresponding dimensions) influence adaptation. The Burke and colleagues model (2006) specifically discusses cognitions, suggesting that adaptive team performance, by definition, requires a change in “cognitive or behavioral goal-directed actions or structures to meet expected or unexpected demands” (p. 1192); however, the discussion is limited to generic SMMs, not specifying which types are most important at any given time. Kozlowski and colleagues (1999) also suggest adaptive performance is comprised of a series of stages, but do not specifically mention shared mental models. However, when considered closely, the underlying mechanisms required for successfully moving through the phases are cognitively based. For example, socialization—the first phase—is focused on reducing social ambiguity, which is often inherent at team formation by seeking knowledge regarding the team. One particular type of knowledge that the authors suggest aids in the socialization process is *interpersonal knowledge*, which is the information that comprises teammate SMMs. Kozlowski also suggests that team orientation aids adaptive performance. The development of a *team orientation* involves the identification of team goals (i.e., what the team is trying to do), team climate (i.e., what it is like to be part of this particular team), and norms for interaction (i.e., acceptable behavior within the team). This provides the necessary boundary conditions within which the team will operate, enabling members to see how each particular individual role aligns with the overall mission of the team and provides a basis for development of shared perceptions (Nieva, Fleishman, & Rieck, 1978). This, essentially, describes team interaction SMMs. If adaptation theory can integrate with team cognition theory, there will be greater specificity with regard to the team level cognitions required for effective adaptation, allowing researchers to target specific dimensions of task, team interaction, and teammate SMMs when conducting team adaptation research. Such integration can streamline research efforts, which facilitates translation of science to practice.

Practical Implications

On a more practical level, organizations trying to recover from economic hardships are tightening control over expenditures by redistributing the workload among existing employees rather than hiring additional help. Military units are stretched as thin as can be afforded; therefore, replacement personnel are not always readily available when needed. Thus, team members are often removed from one team and placed another team. This is not just characteristic of the military—businesses, educational settings, and medical facilities are all dealing with the effects of the recent recession. Although much adaptive team performance research has focused on integration of a new member, research has not adequately considered integration of a member who was previously on another team or the overall effects of member loss without replacement. As this is common practice in industry, science needs to investigate both phenomena together to provide evidence-based recommendations regarding the effectiveness of these practices (member loss and member loss with replacement by existing personnel). Only through systematic investigation can such guidelines be provided to organizations.

This research provides a necessary first step towards understanding the implications of both membership loss and membership loss with replacement on adaptive team performance. Furthermore, various membership fluidity conditions (loss or loss with replacement) differentially influenced the sharedness of teammate MMs. Essentially, removing members without replacement in decision-making tasks that require pooled, uniquely held knowledge caused decrements to the sharedness of task and team interaction MMs in this study. Replacing lost teammates with members who were familiar with the task did not result in decrements to task shared mental models; however, it did influence the sharedness of teammate MMs. Ultimately, teammate SMMs directly influenced adaptive performance, when operationalized as the facets (i.e., dimensions) of teammate SMMs. These findings suggest organizations relying upon such teams cannot engage in downsizing (i.e., loss) or team member reconfigurations (i.e., loss with replacement) without incurring some degree of process loss—and potentially, performance decrements.

In this study, neither task nor team interaction SMMs significantly predicted adaptive performance. Organizations cannot take the lack of findings as an indication that these types of mental models are inconsequential to adaptive performance. Previous meta-analytic research has demonstrated a positive effect of all types of mental models on team performance (DeChurch & Mesmer-Magnus, 2010a, 2010b). However, sometimes research has shown an positive indirect effect of SMMs on team performance through team process (Mathieu et al., 2005) or an interactive effect of the types of mental models on team performance such that highly shared task MMs were positively related to performance only when team MMs were also highly shared (Smith-Jentsch et al., 2005).

Regardless, the findings of this study suggest that membership fluidity influences the development of SMMs. Organizations, and specifically team leaders, need to understand the potential decrements to team cognitions associated with changing team configurations. However, since the practice of membership fluidity is common in organizations, organizations and team leaders need to consider mechanisms to help teams develop task, team interaction, and teammate SMMs in light of these changes. It was speculated that information sharing regarding both taskwork and teamwork would help alleviate decrements to development of SMMs caused by membership fluidity conditions. However, in this particular study, there was a lack of information sharing regarding teamwork as the majority of information shared during the second transition phase revolved around taskwork. It is possible that the sharing of information regarding team roles and boundary conditions (i.e., team interaction SMMs) as well as general preferences for working as measured by various personality measures (i.e., teammate SMMs) in addition to task relevant knowledge could help. However, future research is required to provide empirical evidence supporting this particular suggestion since it is based on theoretical speculation, rather than empirically rooted evidence.

Study Limitations & Future Research

Hypothesis testing did not support the supposition that high levels of task, team interaction and teammate SMMs would positively influence adaptive performance. Methodological and measurement limitations could explain the lack of findings. Mental model literature emphasizes overlapping knowledge of team members as a critical predictor of team effectiveness (Cannon-Bowers et al., 1993; Mathieu et al., 2000). However, researchers have suggested that shared knowledge encompasses perspectives that are both shared and complementary and further argue that the complementary perspective is most appropriate for heterogeneous teams comprised of distinct roles in which performance relies on uniquely held knowledge (Cooke et al., 2003; Cooke, Salas, Cannon-Bowers, & Stout, 2000), which is similar to the notion of transactive memory. In fact, Cooke and colleagues (2000) have suggested that in such teams, researchers should utilize knowledge distribution metrics which identify where specific knowledge lies as gaps in some team members can be compensated for by others if the knowledge is held by any member of the team. The failure to include distributed knowledge component of sharedness, as advocated by some researchers, could explain the lack of findings with regard to mental models. Specifically, in teams requiring pooling of uniquely held knowledge where tasks are divided and roles are distinct, measuring overlapping knowledge may not be predictive of what is truly required for successful performance (Mohammed & Dumville, 2001), particularly when considering adaptation.

As noted previously, Euclidean distance scores were found to be significant more often than correlation scores. Finally, some SMM findings were associated with the similarity index, while others were based on the Euclidean distance. Practically speaking, it is important to consider measurement indices and this study adds additional support to the notion that measurement matters. Smith-Jentsch (2009) articulated these issues in her chapter on team cognitions. She noted that different metrics produce different results and careful consideration should be placed on the specific research questions to select the most appropriate metric. Resick and colleagues (2010) added additional support to Smith-Jentsch's argument by empirically demonstrating that different SMM elicitation methods result in varied relationships with outcomes of interest, such as adaptive team performance. This study is yet another indicator of the importance of measurement. SMM correlations (i.e., similarity indices) were more predictive at times, however, the Euclidian distance scores provided more overall support for hypothesis (and exploratory analysis) testing. This is possibly due to the fact that correlations can be attenuated when members completely agree (restriction of range), either through item or aggregate team-level analyses (i.e., an average self-rating of 4 across items compared to an average other rating of 4 results in lack of a correlation or a correlation of 0.0). However, if the pattern of responses were different such that one rating was 4-5-3 and the other rating was 3-5-4, the distance score would reflect an actual Euclidean distance score of 1.0, which indicates high levels of agreement. Similarly, correlation ratings can also be inflated, in the case of a "perfect" correlation based on the same pattern of responses, but different actual ratings. Consider one person rating 4-5-4-4 and another rating 2-3-2-2. This would be considered a perfect correlation of 1.0. Yet, when calculated as the distance score, it is 4.0, which is considerably less "agreement" than indicated by a perfect correlation. Essentially, the correlations measure the how similar members were able to rate patterns of responses, whereas Euclidean distances measure absolute distance among ratings (whether members figure out that others were either high or low, but just were slightly off regarding the specific pattern of responses). In cases with restriction of range (as discussed above), the Euclidean distance score would more accurately capture the true nature of relatedness.

Exploratory analyses only revealed significant findings for the agreeableness and neuroticism facets of teammate SMMs. This task was social in nature, comprised of ad hoc teams performing in a limited timeframe, without task expertise. In such cases, members can only develop similar views of characteristics that can easily be observed. By operationalizing teammate SMMs as the overall personality index, other facets, such as openness were included in the analyses. This measurement decision could have (and likely did) lead to spurious ratings, introducing a source of error. This would minimize the chance that such mental models would be related to adaptive performance.

As stated previously, the null findings regarding information sharing do not imply that the sharing of information is not important in the development of SMMs or adaptive performance. Instead, it points to potential issues that may have mitigated the influence of information sharing on SMMs in this particular study. For example, there were two planning periods. To measure information exchange that most directly influenced adaptive performance, information sharing was coded during the second transition phase (i.e., planning period). Perhaps intact teams shared all relevant information during their first transition phase and thus, did not need to engage in information sharing during the second planning period. Indeed, team adaptation training often focuses on the importance of moving from explicit communication to implicit communication (Entin & Serfaty, 1999). Others have suggested that this move towards implicit communication translates to a move from explicit to implicit coordination, whereby members dynamically adjust their behaviors based on expectations (e.g., Rico, Sánchez-Manzanares, Gil, & Gibson, 2008) developed through effective previous interaction. This would help explain the lack of findings with regard to information sharing. Perhaps intact teams who were doing well after Time I measurement did not need to engage in information sharing as they had developed effective communication patterns enabling implicit coordination. Furthermore, membership loss teams who effectively shared information during the first transition phase may have been able to translate that effective explicit communication into implicit coordination and thus, were able to effectively adapt behaviors after membership loss with relatively little explicit communication. For these reasons, future team adaptation research needs to specifically consider the change in team communication patterns across time before making conclusions regarding the importance of information sharing.

Teams were encouraged to share both teamwork and taskwork related information through a planning sheet during the first transition period. Unfortunately, it is difficult to disentangle teamwork processes from taskwork as they are often highly intertwined. Both teamwork and taskwork are required for effective team performance (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). However, research suggests that teams seem to be more comfortable sharing task-related information (Weingart, 1992). In supporting this notion, during the second transition phase (i.e., planning period), the majority of teams did not engage in *any* information sharing regarding teamwork, which resulted in an information sharing measure that only captured a portion of information that is required for effectiveness. Therefore, teams researchers should identify ways to (1) isolate teamwork and taskwork discussions within lab settings and (2) encourage sharing of information regarding teamwork across transition periods. This could then provide a wealth of knowledge, not only for adaptation researchers, but for anyone interested in furthering the understanding of team process and, ultimately, effectiveness.

The Claims Staffer was removed from the membership loss teams, and removed and integrated within the membership loss with replacement teams. The choice of this particular role could have influenced results. It was speculated that this particular role required uniquely held knowledge that was required for effective performance. Removal of another member could have significantly influenced results. For example, the Waiting Room Staffer interacted directly with the simulation. Team members had much greater opportunities to observe levels of agreeableness, extroversion, and conscientiousness based on the nature of the tasks required for this role. Perhaps through removal of this member, condition would have more strongly predicted overall Teammate SMMs and that this would have been related to adaptive performance (i.e., partially mediated condition to performance relationship) because participants in these roles had specific knowledge about patients required for effective performance. Furthermore, removal of this role would have required reconfiguration as someone would have had to change roles to engage with the simulation, thus, impacting team interaction SMMs. Finally, this particular role was qualitatively different than the Claims or Records Staffer. Removal of the Waiting Room Staffer would have required remaining members (in the loss condition) to develop an understanding of a very different type of task than the similar tasks of the Claims and Records Staffers. Because of the differences in tasks, removal of the Waiting Room Staffer could have also more dramatically influenced sharedness of task mental models as well. Had more time been spent on piloting, preliminary analyses could have uncovered the impact of removing different members prior to data collection. Future research should investigate how the pattern of results change based on removal of different members. One possibility is to randomize this removal and conduct a study in which there is a direct comparison of the influence of losing each member on the development of SMMs and adaptive performance.

Both graduate and undergraduate college students, of various ages, participated in this research. Given the age ranges mentioned previously across conditions, individuals likely had different experiences working on teams. Although a control variable measure was collected considering member's preference for teams, there was very little variation in this measure. This could be due to the fact that the study was advertised as a team task. Therefore, it is possible that only people who enjoyed (or could tolerate) working in teams signed up for the study. Future research should consider advertising the study as individual timeslots to determine if there are any differences with a wider range of attitudes towards teams.

Due to space limitations, participants arrived in the same waiting area for participation in the study. Although attempts were made to keep members from interacting, there is the possibility that members saw the other team members and suspected that there could be some kind of membership change. This could have resulted in a lack of statistical findings. In attempts to control for this possibility, teams were told immediately upon entering their study rooms that other teams were performing the same task. However, future research should take greater efforts to separate the teams to avoid any potential for this confound.

This study only considered ad hoc teams. As such, the results are only generalizable to teams who do not generally work together. Furthermore, the nature of the tasks within this study forced members to engage in independent taskwork, and then suddenly shift to interdependent teamwork. Research is required to understand how highly familiar teams operate in this type of condition. Perhaps because they have high levels of SMMs regarding teammate preferences and, perhaps even team interactions based on previous experiences working together, these types of mental models may be predictive of performance. Research should also consider how moving from interdependent work to independent work influences the development of SMMs and adaptive performance as previous research suggests that teams have more performance problems when shifting from a functional structure to a divisional structure (Moon et al., 2004). Thus, there could be different performance implications when shifting from interdependent to independent as compared to the independent to interdependent entrainment shifts experienced by teams in this effort.

The length of the task may have also influenced the results. There were two action phases where participants engaged in taskwork and two performance measurement periods. The correlation matrix suggests a different pattern of relationships for the two-person intact control condition as compared to the remainder of the teams. Although one would predict differences in the control conditions as compared to the experimental conditions, it is puzzling as to why there were differences in the two- and three-person intact teams. One possibility is that the division tasks was more clear in the two-person team than the other teams who started with three members. Specifically, in the two-person intact team, one member engaged with the simulation and the other worked with the paperwork. In the three-person teams, there were two people working with patient files and paperwork (Claims Staffer and Records Staffer). This may have caused greater confusion regarding role delineation (affecting team interaction SMMs) and who was responsible for what tasks (affecting task SMM development). Previous research by Smith-Jentsch and colleagues (2001; 2009) suggests that tenure influences development of SMMs. Perhaps if teams had longer to spend working on the simulation, members could have worked out some of these confusions and had more similar SMMs regarding the task and how to go about coordinating those tasks, which could have improved performance. Future research should consider the length of time for studies involving more members to determine if there is a time issue that can confound results.

It must be stated that there were a large number of analyses run in this study. This can lead to findings due to family-wise error rather than actual relationships. Future research is, thus, required to replicate the findings of this study.

Conclusion

Membership changes occur in many teams. The scientific community has suggested several theories regarding adaptation. This effort considered the influence of cognitive components of adaptation—specifically shared mental models. Although all hypotheses were not supported, much can be learned from this effort. First, teams performed differently based on whether they were in the three-person membership control condition or the membership loss with replacement condition. Specifically, intact teams had greater levels of adaptive performance as compared to membership loss with replacement teams. Second, two-person intact teams developed more similar task and team interaction SMMs than teams who experienced membership loss. Third, three-person intact teams developed more similar teammate SMMs regarding the Agreeableness facet. Finally, adaptive performance was greater for teams who had more similar Teammate SMMs regarding the facet of Neuroticism as well as for teams who had less distance in their Agreeableness SMMs.

A number of limitations have been discussed that could have influenced the findings of this study. Future research is encouraged to further disentangle the results in order to (1) improve existing team adaptation theory and (2) provide practitioners with evidence-based guidelines for training teams to be adaptive in any context. Membership fluidity within teams is a common practice that is not diminishing in organizations. The scientific community must continue investigations across tasks and time sequences to more fully understand this organizational practice. Only through careful research designs can we begin to identify the key mediating and moderating process variables that influence how teams adapt to membership loss or loss with replacement.

APPENDIX A: RECORDS VOLUNTEER STAFFER DOCUMENTS

SUMMIT HOSPITAL

Employee Tracking Form

Hospital Clerical Assistant on Duty	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	
Name of Employee	
Date of Arrival	

SUMMIT HOSPITAL

Patient Log Form

Name of patient (if known)	
Gender	
Approximate Age	
Was anyone with the patient? (explain)	
Reason for visit	

APPENDIX B: CLAIMS VOLUNTEER STAFFER DOCUMENTS

Insurance Claim Form

Name of Patient	Jesse Parish
Birthplace	Atlanta, GA
Birthdate	
Occupation	Consultant
Name of Insured	Jesse Parish
Insurance Company	
Insurance Policy Number	QU021=T
Reason for Visit	Patient was experiencing severe nausea after consuming a large amount of sushi from a local restaurant
Additional Comments	Patient will be tested for food poisoning and will likely be able to return home on the same day

Name of Patient	Manny Vasquez
Birthplace	San Juan, Puerto Rico
Birthdate	January 14th, 1979
Occupation	Unknown
Name of Insured	Manny Vasquez
Insurance Company	
Insurance Policy Number	
Reason for Visit	
Additional Comments	

SUMMIT HOSPITAL

Complaint Form

Date	
Individual Making the Complaint	
Individual the Complaint is Directed Towards	
Any Witnesses to Event	
Description of Event	
Date	
Individual Making the Complaint	
Individual the Complaint is Directed Towards	
Any Witnesses to Event	
Description of Event	

APPENDIX C: PRE-MEASURES

Demographic Information

Please answer the questions about yourself and your parents/guardians to the best of your knowledge. If you do not know the answer to the question or the question does not apply to you, please write "N/A" to indicate it is not applicable.

1. What is your sex?
   - ☐ Male
   - ☐ Female

2. What is your age?
   ____

3. What is your race or ethnic background? (check all that apply):
   - ☐ White/Caucasian
   - ☐ Black/African American
   - ☐ Hispanic or Latino
   - ☐ Asian
   - ☐ Pacific Islander or Native Hawaiian
   - ☐ American Indian
   - ☐ Alaskan Native
   - ☐ Middle Eastern
   - ☐ Other: Please Describe____________________

4. If you chose more than one race or ethnic group in the previous question, which one do you most identify with?
   - ☐ White/Caucasian
   - ☐ Black/African American
   - ☐ Hispanic or Latino
   - ☐ Asian
   - ☐ Pacific Islander or Native Hawaiian
   - ☐ American Indian
   - ☐ Alaskan Native
   - ☐ Middle Eastern
   - ☐ Other: Please Describe______________________

5. Are you fluent in more than one language?
   - ☐ Yes
   - ☐ No

   If so, which languages, in order of most fluent to least fluent?
   ____

6. Marital Status:
   - ☐ Single
   - ☐ Married
   - ☐ Separated

☐ Divorced
☐ Widowed
☐ Living with Another
☐ Domestic Partnership

7. Class:
   ☐ Freshman
   ☐ Sophomore
   ☐ Junior
   ☐ Senior
   If Senior – please indicate your year (i.e. 4th year, 5th year, etc.) ____________________

8. How many credit hours are you enrolled in this semester? __________________________

9. Major: _______________________

10. Minor: _______________________

11. Do you have any other degrees?
    ☐ Yes
    ☐ No
    If Yes, please list them here: __________________________________

12. What is your employment status?
    ☐ Not Employed, Full-time Student
    ☐ Not Employed, Part-time Student
    ☐ Employed Part-Time
    ☐ Employed Full-Time
    ☐ Self-Employed

13. UCF GPA: ___________

14. SAT Score: ___________
    Verbal:___________
    Math: ___________

15. ACT Score: ___________

16. Are you the first one in your immediate family to attend college?
    ☐ Yes
    ☐ No
17. What is the highest education level of your mother?
    ☐ High School
    ☐ Some College
    ☐ 2-year College Degree
    ☐ 4-year College Degree

- ☐ Some Graduate School
- ☐ Master's Degree
- ☐ Doctorate (including a Juris Doctorate – law degree)

18. What is the highest education level of your father?
    - ☐ High School
    - ☐ Some College
    - ☐ 2-year College Degree
    - ☐ 4-year College Degree
    - ☐ Some Graduate School
    - ☐ Master's Degree
    - ☐ Doctorate (including a JD)

Mini-IPIP

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP scales: Tiny-yet-effective measures of the Big Five factors of personality. *Psychological Assessment, 18(2)*, 192-203.

E=Extraversion; A=Agreeableness; C=Conscientiousness; N=Neuroticism; I=Intellect/Imagination;

Scale

1 (Very Inaccurate)
2 (Moderately Inaccurate)
3 (Neither Inaccurate nor Accurate)
4 (Moderately Accurate)
5 (Very Accurate)

Below you will see phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully. I…

1. Am the life of the party. (E)5
2. Sympathize with others' feelings. (A)19
3. Get chores done right away. (C)9
4. Have frequent mood swings. (N)13
5. Have a vivid imagination. (I)11
6. Don't talk a lot. (r) (E)7
7. Am not interested in other people's problems. (r) (A)2
8. Often forget to put things back in their proper place. (r) (C)17
9. Am relaxed most of the time. (r) (N)4
10. Am not interested in abstract ideas. (r) (I)1
11. Talk to a lot of different people at parties. (E)20
12. Feel others' emotions. (A)8
13. Like order. (C)15
14. Get upset easily. (N)10
15. Have difficulty understanding abstract ideas. (r) (I)12
16. Keep in the background. (r) (E)14
17. Am not really interested in others. (r) (A)3
18. Make a mess of things. (r) (C)16
19. Seldom feel blue. (r) (N)18
20. Do not have a good imagination. (r) (I)6

Goal Orientation

VandeWalle, D. M. (1997). Development and validation of a work domain goal orientation instrument. *Educational and Psychological Measurement, 57*, 995-1015.

Scale

1 = Strongly Disagree →6 = Strongly Agree

Learning Goal Orientation

1. I am willing to select a challenging work assignment that I can learn a lot from.
2. I often look for opportunities to develop new skills and knowledge.
3. I enjoy challenging and difficult tasks at work where I'll learn new skills.
4. For me, development of my work ability is important enough to take risks.
5. I prefer to work in situations that require a high level of ability and talent.

Prove (Performance Goal) Orientation

1. I'm concerned with showing that I can perform better than my coworkers.
2. I try to figure out what it takes to prove my ability to others at work.
3. I enjoy it when others at work are aware of how well I am doing.
4. I prefer to work on projects where I can prove my ability to others.

Avoid (Performance Goal) Orientation

1. I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others.
2. Avoiding a show of low ability is more important to me than learning a new skill.
3. I'm concerned about taking on a task at work if my performance would reveal that I had low ability.
4. I prefer to avoid situations at work where I might perform poorly.

Tolerance for Ambiguity

Mclain, D. L. (1993). The Mstat-I: A new measure of an individual's tolerance for ambiguity. *Educational and Psychological Measurement, 53,* 183-189.

Scale

1 = Strongly Disagree → 5 = Strongly Agree

1. I don't tolerate ambiguous situations well. (R)
2. I find it difficult to respond when faced with an unexpected event. (R)
3. I don't think new situations are any more threatening than familiar situations.
4. I'm drawn to situations which can be interpreted in more than one way.
5. I would rather avoid solving a problem that must be viewed from several different perspectives. (R)
6. I try to avoid situations which are ambiguous. (R)
7. I am good at managing unpredictable situations.
8. I prefer similar situations to new ones. (R)
9. Problems which cannot be considered from just one point of view are a little threatening. (R)
10. I avoid situations which are too complicated for me to easily understand. (R)
11. I am tolerant of ambiguous situations.
12. I enjoy tackling problems which are complex enough to be ambiguous.
13. I try to avoid problems which don't seem to have only one "best" solution. (R)
14. I often find myself looking for something new, rather than trying to hold things constant in my life.
15. I generally prefer novelty over familiarity.
16. I dislike ambiguous situations. (R)
17. Some problems are so complex that just trying to understand them is fun.
18. I have little trouble coping with unexpected events.
19. I pursue problem situations which are so complex some people call them "mind boggling."
20. I find it hard to make a choice when the outcome is uncertain. (R)
21. I enjoy an occasional surprise.
22. I prefer a situation in which there is some ambiguity.

Familiarity

Scale from Smith-Jentsch team simulation study

Directions: The following questions concern your familiarity with your experimental partners (i.e., your ER teammates).

1) What role did you assume?
   a) Waiting Room Volunteer Staffer
   b) Records Volunteer Staffer
   c) Claims Volunteer Staffer

<u>Regarding the Waiting Room Volunteer Staffer:</u>

2) How would you describe your relationship with this person?
   a) Relative
   b) Close Friend
   c) Acquaintance (e.g., classmate, neighbor)
   d) Roommate
   e) Coworker
   f) Significant other (husband, wife, fiancée; boyfriend/girlfriend)
   g) No prior relationship

3) How long have you known this person? ______

4) On average over the last 6 months, how often have you interacted with this person?
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) Never

5) In the time since you first met, your most frequent level of interaction was
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) N/A

6) How often have you observed this person in the following contexts?
   a) Interacting with co-workers at work
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   b) Interacting with an authority figure at work (e.g., supervisor, team leader)?

(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

c) Interacting with professors or instructors at school?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

d) Interacting with other students in class?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

e) Interacting with you, one –on-one?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

f) Interacting in a group social setting?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

g) Interacting with his/her family or significant other?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

h) Interacting with strangers?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

Regarding the Records Volunteer Staffer:

7) How would you describe your relationship with this person?
a) Relative
b) Close Friend

c) Acquaintance (e.g., classmate, neighbor)
d) Roommate
e) Coworker
f) Significant other (husband, wife, fiancée; boyfriend/girlfriend)
g) No prior relationship

8) How long have you known this person? ______

9) On average over the last 6 months, how often have you interacted with this person?
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) Never

10) In the time since you first met, your most frequent level of interaction was
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) N/A

11) How often have you observed this person in the following contexts?
   a) Interacting with co-workers at work
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   b) Interacting with an authority figure at work (e.g., supervisor, team leader)?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   c) Interacting with professors or instructors at school?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   d) Interacting with other students in class?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)

(4) More often than I can count

e) Interacting with you, one –on-one?
   (1) Never
   (2) Only once
   (3) More than once (please indicate approximately how many times___)
   (4) More often than I can count

f) Interacting in a group social setting?
   (1) Never
   (2) Only once
   (3) More than once (please indicate approximately how many times___)
   (4) More often than I can count

g) Interacting with his/her family or significant other?
   (1) Never
   (2) Only once
   (3) More than once (please indicate approximately how many times___)
   (4) More often than I can count

h) Interacting with strangers?
   (1) Never
   (2) Only once
   (3) More than once (please indicate approximately how many times___)
   (4) More often than I can count

Regarding the Claims Volunteer Staffer:

12) How would you describe your relationship with this person?
   a) Relative
   b) Close Friend
   c) Acquaintance (e.g., classmate, neighbor)
   d) Roommate
   e) Coworker
   f) Significant other (husband, wife, fiancée; boyfriend/girlfriend)
   g) No prior relationship

13) How long have you known this person? _____

14) On average over the last 6 months, how often have you interacted with this person?
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) Never

15) In the time since you first met, your most frequent level of interaction was
   a) Almost every day
   b) More than once a week
   c) About once a week
   d) Less than once a week
   e) N/A

16) How often have you observed this person in the following contexts?
   a) Interacting with co-workers at work
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   b) Interacting with an authority figure at work (e.g., supervisor, team leader)?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   c) Interacting with professors or instructors at school?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   d) Interacting with other students in class?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   e) Interacting with you, one –on-one?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   f) Interacting in a group social setting?
      (1) Never
      (2) Only once
      (3) More than once (please indicate approximately how many times___)
      (4) More often than I can count

   g) Interacting with his/her family or significant other?
      (1) Never

(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

h) Interacting with strangers?
(1) Never
(2) Only once
(3) More than once (please indicate approximately how many times___)
(4) More often than I can count

APPENDIX D: 3-PERSON TEAMWORK PLANNING SHEET

Preliminary Planning Sheet

1. **Choose a scribe to record the team's responses to each of the items on this worksheet. Indicate that person's letter here: __________________**

2. **Now, think about the following tasks. Based on your training of the various jobs, next to each task below, indicate the letter of the person who will be responsible for overseeing its completion.**

   Interact with Patients: __________________

   Interact with Office Staff: __________________

   Complete Employee Forms: __________________

   Complete Customer Tracking Forms: __________________

   Complete Insurance Claim Form: __________________

   Complete Complaint Claim Form: __________________

3. **In column (A), detail each of those three tasks above by identifying two specific tasks for each one and, in column (B), the resources required for completion of that task.**

(A) Additional Tasks	(B) Resources Required
1) Interact w/ Patients	
2) Interact w/ Office Staff	

3) Complete Employee Tracking Form	
4) Complete Customer Tracking Form	
5) Complete Insurance Claim Form	
6) Complete Complaint Claim Forms	

4. **Take a few moments to examine the resources that are available to you to complete these tasks. Answer the following questions for each task:**

   a) Do you have the required resources to accomplish this task?
   <u>Interact with Patients Staff:</u>

   <u>Interact with Office Staff:</u>

   <u>Complete Employee Tracking Form:</u>

Complete Customer Tracking Form:

Complete Insurance Claim Form:

Complete Complaint Claim Forms:

b) Are all members of the team aware of their individual resources?
Interact with Patients Staff:

Interact with Office Staff:

Complete Employee Tracking Form:

Complete Customer Tracking Form:

Complete Insurance Claim Form:

Complete Complaint Claim Forms:

c) Are there any subtasks that have not yet been identified that are critical to success?

Interact with Patients Staff:

Interact with Office Staff:

Complete Employee Tracking Form:

Complete Customer Tracking Form:

Complete Insurance Claim Form:

Complete Complaint Claim Forms:

d) If so, what resources are required to accomplish each of those tasks?

Interact with Patients Staff:

Interact with Office Staff:

Complete Employee Tracking Form:

Complete Customer Tracking Form:

Complete Insurance Claim Form:

Complete Complaint Claim Forms:

5. **In the remaining time, review the task requirements and resources. Clarify any questions or issues.**

APPENDIX E: 2-PERSON TEAMWORK PLANNING WORKSHEET

Preliminary Planning Sheet B

1. **Choose a scribe to record the team's responses to each of the items on this worksheet. Indicate that person's member letter here: ____________________**

2. **Now, talk about each other's strengths and weaknesses. Next to each role below, indicate the letter of the team member who will be responsible for completing required tasks within that role and a brief description of the knowledge, skills or abilities that he/she has, which make him/her suitable for fulfilling the duties of this role.**

   Waiting Room Volunteer Staffer: ____

   Claims & Records Volunteer Staffer: ____

3. **In column (A), detail each of those three roles above by identifying two specific tasks for each one, in column (B), the letter of the member who will be responsible for doing each, and in column (C), the letter of the member who will provide back-up should it be needed.**

(A) Tasks	(B) Other Team Members That I Must Work With to Accomplish The Task	(C) What member will provide backup, should it be needed?
1) Waiting Room Volunteer Staffer		

(A) Tasks	**(B) Other Team Members That I Must Work With to Accomplish The Task**	**(C) What member will provide back up, should it be needed?**
2) Claims & Records Volunteer Staffer		

4. **Take a few moments to consider your specific role. Answer the following questions for each team member:**

   a) **How will you address overlapping roles, if any should arise?**
   Waiting Room Volunteer Staffer & Claims/Records Volunteer Staffer:

   b) **Whom must you talk to in order to get your task completed?**
   Waiting Room Volunteer Staffer:

   Claims/Records Volunteer Staffer:

   c) **How will you communicate with one another?**
   Waiting Room Volunteer Staffer:

Claims/Records Volunteer Staffer:

When will you need to share information with teammates?
Waiting Room Volunteer Staffer:

Claims/Records Volunteer Staffer:

5. **Spend some time discussing how you, as a team, will address any problems that arise in as you work together as a team. Write that information down once the team has agreed upon a plan.**

6. **Spend some time discussing how you, as a team, will help keep everyone on task and motivated to engage in their respective roles as you work together as a team. Write that information down once the team has agreed upon a plan.**

7. **Have all team members agreed to the team norms established in this document?**
   YES ☐ **NO** ☐

8. **In the remaining time, review the roles, resources, and who must interact with whom to accomplish the goal. Clarify any questions or issues.**

APPENDIX F: IN-TASK SURVEY I

Role Comprehension

Original scale

Scale

1= To a very small extent → 5= To a very large extent

1. My role is
    a. Waiting Room Volunteer Staffer
    b. Medical Records Volunteer Staffer
    c. Claims Volunteer Staffer
2. I understand the requirements of my role.
3. I understand the requirements of the Waiting Room Volunteer Staffer.
4. I understand the requirements of the Medical Records Volunteer Staffer.
5. I understand the requirements of the Claims Volunteer Staffer.

APPENDIX G: PERFORMANCE MEAUSRES

Sim I

Emergency Severity Index

Can the patient wait? If no...

→ **Level 1**

Does patient have time-sensitive issue (e.g., chest pain, stroke symptoms) that requires a doctor plus multiple resources (e.g., X-Ray, Sutures, Lab Work, EKG, Speciality Consult, or IV Fluids)? If yes...

→ **Level 2**

Does patient have non-time sensitive issue that requires a doctor plus one or more resources (e.g., X-Ray, Sutures, Lab Work, EKG, Speciality Consult, or IV Fluids)? If yes...

→ **Level 3**

Does patient have non-time sensitive issue that requires no resources except a doctor? If yes...

→ **Level 4**

Session:
Date:
Time:
Emergency Room #:

Level 1	**Level 2**	**Level 3**	**Level 4**

Sim II

Emergency Severity Index

Can the patient wait? If no...

→ **Level 1**

Does patient have time-sensitive issue (e.g., chest pain, stroke symptoms) that requires a doctor plus multiple resources (e.g., X-Ray, Sutures, Lab Work, EKG, Speciality Consult, or IV Fluids)? If yes...

→ **Level 2**

Does patient have non-time sensitive issue that requires a doctor plus one or more resources (e.g., X-Ray, Sutures, Lab Work, EKG, Speciality Consult, or IV Fluids)? If yes...

→ **Level 3**

Does patient have non-time sensitive issue that requires no resources except a doctor? If yes...

→ **Level 4**

Session:
Date:
Time:
Emergency Room #:

Level 1	**Level 2**	**Level 3**	**Level 4**

APPENDIX H: IN-TASK SURVEY II

Team Process Action/Interpersonal Subscales Time 1

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team process. *Academy of Management Review, 26,* 356-376.

Scale

1= Not at all → 5 = To a Very Great Extent

To what extent does our team actively work to…

Action Processes

Monitoring Progress Toward Goals

1. Regularly monitor how well we are meeting our team goals?
2. Use clearly defined metrics to assess our progress?
3. Seek timely feedback from stakeholders (e.g., customers, top management, other organizational units) about how well we are meeting our goals?

Resource and Systems Monitoring

4. Monitor and manage our resources (e.g., financial, equipment, etc.)?
5. Monitor important aspects of our work environment (e.g., inventories, equipment and process operations, information flows)?
6. Monitor events and conditions outside the team that influence our operations?

Team Monitoring and Backup

7. Develop standards for acceptable team member performance?
8. Balance the workload among our team members?
9. Assist each other when help is needed?

Coordination

10. Communicate well with each other?
11. Smoothly integrate our work efforts?
12. Coordinate our activities with one another?

Interpersonal Processes

Conflict Management

13. Deal with personal conflicts in fair and equitable ways?
14. Show respect for one another?
15. Maintain group harmony?

Motivating & Confidence Building

16. Take pride in our accomplishments?
17. Develop confidence in our team's ability to perform well?
18. Encourage each other to perform our very best?

Affect Management

19. Share a sense of togetherness and cohesion?
20. Manage stress?
21. Keep a good emotional balance in the team?

APPENDIX I: IN-TASK SURVEY III

Taskwork Mental Model

Original scale, based on Mathieu et al. (2000).

Emergency Room #: ______________________________

Date: ______________________________

Time: ______________________________

Employee Position: ______________________________

Task Grid

Instructions: Below are several descriptions of the **"task" aspects of this job**. Please rate how related each aspect is to all of the others to complete the mission. For example, in the uppermost square, you would rate how **Patient & Staff Communication** is related to **Making Announcements**. Rate all **Non-Shaded** boxes.

	-4	-3	-2	-1	0	+1	+2	+3	+4
Negatively Related A high degree of one requires a low degree of the other.					**Totally Unrelated**				**Positively Related** a high degree of one requires a high degree of the other.

<u>Operational Definitions:</u>

1. **Patient & Staff Communication:** Respond to patient, family, and staff requests for information
2. **Making Announcements:** Using the PA to make announcements as requested by staff members
3. **Recording Patient & Employee Information:** Filling out the Patient Log & Employee Tracking Log
4. **Updating Patient Insurance Forms**
5. **Recording Complaints:** Filling out Complaint Form
6. **Tracking Critical Updates**

	Making Announcements	Recording Patient & Employee Information	Updating Patient Insurance Forms	Recording Complaints	Tracking Critical Updates
Patient & Staff Communication					
Making Announcements					
Recording Patient & Employee Information					
Updating Patient Insurance Forms					
Recording Complaints					

Teamwork Mental Model

Original scale

Emergency Room #: ______________________________

Date: ______________________________

Time: ______________________________

Employee Position: ______________________________

Team Grid

Instructions: Below are several descriptions of the **"people" aspects of this job**. Please rate how related each aspect is to all of the others to complete the mission. For example, in the uppermost square, you would rate how **Goal Specification** is related to **Strategy Formulation and Planning**. Rate all **Non-Shaded** boxes.

	-4	-3	-2	-1	0	+1	+2	+3	+4
Negatively Related A high degree of one requires a low degree of the other.					**Totally Unrelated**				**Positively Related** a high degree of one requires a high degree of the other.

Operational Definitions:

1. **Goal Specification:** What is our mission's goals, from most to least important?
2. **Strategy Formulation and Planning:** How are we going to accomplish this mission? What do we do if our plan goes wrong? How should we adjust our plan now, given this new situation?
3. **Team Monitoring and Backup Behavior:** Assisting team members to perform their tasks by providing verbal feedback or coaching, assisting a teammate in carrying out actions, or by completing a task for a teammate.
4. **Coordination Activities:** How should we coordinate our roles? How do we address role overlaps?
5. **Conflict Management:** What do we have to do in order to avoid destructive conflict? How do we stop this destructive conflict?
6. **Motivating and Confidence Building:** How do we motivate and raise each others' confidence?
7. **Affect Management:** How do we maintain a positive atmosphere while performing?

	Strategy Formulation & Planning	Team Monitoring & Backup Behavior	Coordination Activities	Conflict Management	Motivating & Confidence Building	Affect Management
Goal Specification						
Strategy Formulation & Planning						
Team Monitoring & Backup Behavior						
Coordination Activities						
Conflict Management						
Motivating and Confidence Building						

APPENDIX J: IN-TASK SURVEY IV

Team Process Action/Interpersonal Subscales Time 2

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team process. *Academy of Management Review, 26,* 356-376.

***Directions for CONTROL GROUP*: Please complete these measures with regard to the very last round of performance.**

***Directions for NON CONTROL GROUPS*: Please complete these measures with how you see your current team now, during this last round of performance.**

Scale

1= Not at all → 5 = To a Very Great Extent

To what extent does our team actively work to…

Action Processes

Monitoring Progress Toward Goals

1. Regularly monitor how well we are meeting our team goals?
2. Use clearly defined metrics to assess our progress?
3. Seek timely feedback from stakeholders (e.g., customers, top management, other organizational units) about how well we are meeting our goals?

Resource and Systems Monitoring

4. Monitor and manage our resources (e.g., financial, equipment, etc.)?
5. Monitor important aspects of our work environment (e.g., inventories, equipment and process operations, information flows)?
6. Monitor events and conditions outside the team that influence our operations?

Team Monitoring and Backup

7. Develop standards for acceptable team member performance?
8. Balance the workload among our team members?
9. Assist each other when help is needed?

Coordination

10. Communicate well with each other?
11. Smoothly integrate our work efforts?
12. Coordinate our activities with one another?

Interpersonal Processes

Conflict Management

13. Deal with personal conflicts in fair and equitable ways?
14. Show respect for one another?
15. Maintain group harmony?

Motivating & Confidence Building

16. Take pride in our accomplishments?
17. Develop confidence in our team's ability to perform well?
18. Encourage each other to perform our very best?

Affect Management

19. Share a sense of togetherness and cohesion?
20. Manage stress?
21. Keep a good emotional balance in the team?

APPENDIX K: UCF IRB HUMAN SUBJECTS PERMISSION LETTER

University of Central Florida

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Wendy L. Bedwell**

Date: **April 10, 2012**

Dear Researcher:

On 4/10/2012, the IRB approved the following human participant research until 4/9/2013 inclusive:

Type of Review:	UCF Initial Review Submission Form
Project Title:	Team Member Interactions and Team Performance
Investigator:	Wendy L Bedwell
IRB Number:	SBE-12-08298
Funding Agency:	NASA
Grant Title:	Optimizing crew performance in long duration space exploration: Best practices for team training and cohesion measurement with the overarching study title of Cohesion Optimization in NASA Spaceflight Teams Experiencing Long-duration Assignment: Training and Indices for Optimizing Performance and Gaining Astronaut Synergy Under Stress (PROJECT PEGASUS)
Research ID:	1048683

The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

If continuing review approval is not granted before the expiration date of 4/9/2013, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., CF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 04/10/2012 10:53:36 AM EDT

IRB Coordinator

APPENDIX L: INFORMED CONSENT WAIVER

Team Member Interactions and Team Performance

Informed Consent

Principal Investigator(s):	Wendy L. Bedwell, M.D.E.
Faculty Supervisor:	Eduardo Salas, Ph.D.
Sponsor:	NASA
Investigational Site(s):	UCF Psychology Department

Introduction: Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 132 people. You must be 18 years of age or older to be included in the research study.

The person doing this research is Wendy Bedwell of the University of Central Florida, Department of Psychology. Because the researcher is a graduate student, she is being guided by Dr. Eduardo Salas, a UCF faculty supervisor in the Psychology Department. UCF students learning about research are helping to do this study as part of the research team. Their names are: Anthony Kees, Scott Ramsay, Jeremy Mortenson, Christina Kinard, Jack Miller, Char'Lee Tubbs, Jeff Adams, Katrina Hodapp, Rodaina Qutteineh, Katie Ayres, Chelsea Tarbox, Mehak Arshad, and Jason Brigham.

What you should know about a research study:

- Someone will explain this research study to you.
- A research study is something you volunteer for.
- Whether or not you take part is up to you.
- You should take part in this study only because you want to.
- You can choose not to take part in the research study.
- You can agree to take part now and later change your mind.
- Whatever you decide it will not be held against you.
- Feel free to ask all the questions you want before you decide.

Purpose of the research study: The purpose of this study is to understand how team members interact and how those interactions influences team performance.

What you will be asked to do in the study: Throughout this study, you will be working on tasks within a team. Essentially you are playing the role of a new volunteer staffer in a hospital emergency room waiting area. Depending on your assigned role within your team, you may either be working with patient and hospital staff files, receiving communication from hospital staff via computer chat, or interacting with characters in a video-based simulation of an ER emergency room waiting room. You will be asked to watch a brief training video, engage in various hospital volunteer staffer tasks (based on your particular role), and complete several surveys called "hospital paperwork" throughout the session. For the surveys, if you do not feel comfortable answering a question, you may select "prefer not to answer." You will not lose benefits if you select those options.

Location: The research will take place in this room here in the psychology department.

Time required: We expect that you will be in this research study for 2 ½ hours.

Benefits of this research: There are no direct benefits to you for taking part in this study.

Audio or video taping: You will be audio taped during this study. If you do not want to be audio taped, you will not be able to be in the study. Discuss this with the researcher or a research team member. If you are audio taped, the tape will be kept in a locked, safe place. The tape will be erased or destroyed as soon as it is transcribed and coded. You will also be videotaped during this study. If you do not want to be video taped, you will not be able to be in the study. Discuss this with the researcher or a research team member. If you are video taped, the tape will be kept in a locked, safe place. The tape will be erased or destroyed when transcribed and coded.

Funding for this study: This research study is being paid for by NASA.

Compensation or payment: Compensation for your participation will be $25 for the two and ½ hour session ($10.00 per hour). If you complete any part of the experiment, you will receive compensation for the time you have spent in the experiment. Additionally, your team will be eligible to win a performance reward at based on how well your team performs as compared to other teams who are engaging in similar tasks. First place teams will receive an additional $25 per person. Second place teams will receive an additional $20 per person. Third place teams will receive an additional $15 per person. Once all data has been collected, we will analyze the results to determine the winners. Winning teams will be notified via email with further instructions on how to claim their prize money. Should any winning participants no longer be in the area once data is analyzed, we will arrange to send the prize money to him/her through the mail in accordance with the wishes of the participant.

Confidentiality: We will limit your personal data collected in this study to people who have a need to review this information. We cannot promise complete secrecy; however, every effort will be taken to ensure data is maintained in a confidential manner.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, or think the research has hurt you, talk to Wendy Bedwell, Graduate Student, Industrial/Organizational Psychology, College of Sciences at (407) 882-1347 or wbedwell@ist.ucf.edu or Dr. Eduardo Salas, Faculty Supervisor, Department of Psychology and Institute for Simulation & Training at (407) 882-1345 or esalas@ist.ucf.edu.

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901. You may also talk to them for any of the following:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

REFERENCES

Ancona, D. (1990). Outward bound: Strategies for team survival in an organization. *Academy of Management Journal, 33*(2), 334-365.

Argote, L. (1999). *Organizational learning: Creating, retaining, and transferring knowledge*. Norwell, MA: Kluwer.

Baer, M., Leenders, R., Oldham, G., & Vadera, A. (2010). Win or lose the battle for creativity: the power and perils of intergroup competition. *Academy of Management Journal, 53*(4), 827-845.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182. doi: 10.1037/0022-3514.51.6.1173

Burke, C. S., Salas, E., Diaz Granados, D., Sessa, V. I., & London, M. (2008). The role of team learning in facilitating team adaptation within complex environments: Tools and strategies *Work group learning: Understanding, improving and assessing how groups learn in organizations.* (pp. 217-241). New York, NY: Taylor & Francis Group/Lawrence Erlbaum Associates.

Burke, C. S., Stagl, K. C., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding team adaptation: A conceptual analysis and model. *Journal of Applied Psychology, 91*(6), 1189-1207.

Campbell, J. P. (1990). Modeling the performance prediction problem in industrial and organizational psychology. In M. D. Dunnette & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 1, pp. 687-732). Palo Alto, CA: Consulting Psychologists Press.

Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making *Individual and group decision making: Current issues.* (pp. 221-246): Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.

Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining competencies and establishing team training requirements. In R. A. Guzzo & E. Salas (Eds.), *Team effectiveness and deision making in organiations* (pp. 333-380). San Francisco: Jossey-Bass.

Cascio, W. F. (1999). *Costing human resources* (4th ed ed.). Dallas, TX: Southwestern College Publishing.

Chen, G. (2005). Newcomer adaptation in teams: Multilevel antecedents and outcomes. *Academy of Management Journal, 48*(1), 101-116.

Chen, G., Thomas, B., & Wallace, J. C. (2005). A multilevel examination of the relationships among training outcomes, mediating regulatory processes, and adaptive performance. *Journal of Applied Psychology, 90*(5), 827-841. doi: 10.1037/0021-9010.90.5.827

Choi, H., & Thompson, L. (2005). Old wine in a new bottle: Impact of membership change on group creativity. *Organizational Behavior and Human Decision Processes, 98*(2), 121-132. doi: 10.1016/j.obhdp.2005.06.003

Cooke, N. J., Kiekel, P. A., & Helm, E. E. (2001). Measuring team knowledge during skill acquisition of a complex task. *International Journal of Cognitive Ergonomics, 5*(3), 297-315. doi: 10.1207/s15327566ijce0503_10

Cooke, N. J., Kiekel, P. A., Salas, E., Stout, R., Bowers, C., & Cannon-Bowers, J. (2003). Measuring team knowledge: A window to the cognitive underpinnings of team performance. *Group Dynamics: Theory, Research, and Practice, 7*(3), 179-199. doi: 10.1037/1089-2699.7.3.179

Cooke, N. J., Salas, E., Cannon-Bowers, J. A., & Stout, R. J. (2000). Measuring team knowledge. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 42*(1), 151-173. doi: 10.1518/001872000779656561

De La Hera, C., & Rodriguez, F. (1999). The effects of member change and continuity on the productive efficiency of work teams. *Psychology in Spain, 3*(1), 88-97.

DeChurch, L. A., & Mesmer-Magnus, J. R. (2010a). The cognitive underpinnings of effective teamwork: A meta-analysis. *Journal of Applied Psychology, 95*(1), 32-53. doi: 10.1037/a0017328

DeChurch, L. A., & Mesmer-Magnus, J. R. (2010b). Measuring shared team mental models: A meta-analysis. *Group Dynamics: Theory, Research, and Practice, 14*(1), 1-14. doi: 10.1037/a0017455

DeRue, D. S., Hollenbeck, J. R., Johnson, M. D., Ilgen, D. R., & Jundt, D. K. (2008). How different team downsizing approaches influence team-level adaptation and performance. *Academy of Management Journal, 51*(1), 182-196.

Diedrich, F. J., Entin, E. E., Hutchins, S. G., Hocevar, S. P., Rubineau, B., & MacMillan, J. (2003). When do organizations need to change (Part I)? Coping with incongruence. *Proceedings of the 8th International Command and Control Research and Technology Symposium*, Washington, DC.

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The Mini-IPIP Scales: Tiny-yet-effective measures of the Big Five factors of personality. *Psychological Assessment, 18*(2), 192-203. doi: 10.1037/1040-3590.18.2.192

Edmondson, A. C. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*(2), 350-383.

Edmondson, A. C. (2002). The local and variegated nature of learning in organizations: A group-level perspective. *Organization Science, 13*(2), 128-146.

Edmondson, A. C. (2003). Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies, 40*(6), 1419-1452. doi: 10.1111/1467-6486.00386

Edmondson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: Team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*(4), 685-716.

Edmondson, A. C., Dillon, J. R., & Roloff, K. S. (2007). Three perspectives on team learning: Outcome improvement, task mastery, and group process. *Academy of Management Annals, 1*, 269-314. doi: 10.1080/078559811

Edmondson, A. C., Winslow, A. B., Bohmer, R. M. J., & Pisano, G. P. (2003). Learning how and learning what: Effects of tacit and codified knowledge on performance improvement following technology adoption. *Decision Sciences, 34*(2), 197-224. doi: 10.1111/1540-5915.02316

Edwards, B. D., Day, E. A., Arthur, W., Jr., & Bell, S. T. (2006). Relationships among team ability composition, team mental models, and team performance. *Journal of Applied Psychology, 91*(3), 727-736.

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.

Eitzen, D. S., & Yetman, N. R. (1972). Managerial change, longevity, and organizational effectiveness. *Administrative Science Quarterly, 17*(1), 110-116.

Entin, E. E., & Serfaty, D. (1999). Adaptive team coordination. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 41*(2), 312-325. doi: 10.1518/001872099779591196

Entin, E. E., Weil, S., See, K., & Serfaty, D. (2005). Understanding team adaption via team communication. *The Office of Naval Research*, 1-7.

Feldman, D. C. (1994). Who's socializing whom? The impact of socializing newcomers on insiders, work groups, and organizations. *Human Resource Management Review, 4*(3), 213-233. doi: 10.1016/1053-4822(94)90013-2

Furnham, A., & Ribchester, T. (1995). Tolerance of ambiguity: A review of the concept, its measurement and applications. *Current Psychology, 14*(3), 179-199. doi: 10.1007/bf02686907

Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task-performing groups. *Organizational Behavior and Human Decision Processes, 47*, 65-97.

Gibson, C. B. (2001). From knowledge accumulation to accommodation: Cycles of collective cognition in work groups. *Journal of Organizational Behavior, 22*, 121-134.

Goodman, P. S., & Leyden, D. P. (1991). Familiarity and group productivity. *Journal of Applied Psychology, 76*(4), 578-586. doi: 10.1037/0021-9010.76.4.578

Gruenfeld, D. H., Mannix, E. A., Williams, K. Y., & Neale, M. A. (1996). Group composition and decision making: How member familiarity and information distribution affect process and performance. *Organizational Behavior and Human Decision Processes, 67*, 1-15.

Grusky, O. (1963). Managerial succession and organizational effectiveness. *American Journal of Sociology, 69*(1), 21.

Guest, R. H. (1962). Managerial succession in complex organizations. *The American Journal of Sociology, 68*, 47-54.

Harrison, G. L., McKinnon, J. L., Wu, A., & Chow, C. W. (2000). Cultural influences on adaptation to fluid workgroups and teams. *Journal of International Business Studies, 31*(3), 489-505.

Hirst, G. (2009). Effects of membership change on open discussion and team performance: The moderating role of team tenure. *European Journal of Work and Organizational Psychology, 18*(2), 231-249.

Hollingshead, A. B. (2001). Cognitive interdependence and convergent expectations in transactive memory. *Journal of Personality and Social Psychology, 81*(6), 1080-1089. doi: 10.1037/0022-3514.81.6.1080

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 1*, 88-115.

Ilgen, D. R. (1994). Jobs and roles: Accepting and coping with the changing structure of organizations. In M. G. Rumsey, C. B. Walker & J. H. Harris (Eds.), *Personnel selection and classification.* (pp. 13-32). Hillsdale, NJ England: Lawrence Erlbaum Associates, Inc.

Kane, A. A., Argote, L., & Levine, J. M. (2005). Knowledge transfer between groups via personnel rotation: Effects of social identity and knowledge quality. *Organizational Behavior and Human Decision Processes, 96*(1), 56-71. doi: 10.1016/j.obhdp.2004.09.002

Kenny, D. A., Kashy, D. A., & Bolger, N. (1998). Data analysis in social psychology. In D. T. Gilbert, S. T. Fiske & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol. 1 and 2, pp. 233-265). New York, NY: McGraw-Hill.

Kim, P. H. (1997). When what you know can hurt you: A study of experiential effects on group discussion and performance. *Organizational Behavior and Human Decision Processes, 69*, 165-177.

Kozlowski, S. W. J., Gully, S. M., Nason, E. R., & Smith, E. M. (1999). Developing adaptive teams: A theory of compilation and performance across levels and time. In D. R. Ilgen & E. D. Pulakos (Eds.), *The changing nature of work performance: Implications for staffing, personnel actions, and development* (pp. 240-292). San Francisco: Jossey-Bass.

Kozlowski, S. W. J., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions.* (pp. 3-90). San Francisco, CA US: Jossey-Bass.

LePine, J. A. (2003). Team adaptation and postchange performance: Effects of team composition in terms of members' cognitive ability and personality. [Research Support, U.S. Gov't, Non-P.H.S.]. *Journal of Applied Psychology, 88*(1), 27-39.

LePine, J. A. (2005). Adaptation of teams in response to unforeseen change: Effects of goal difficulty and team composition in terms of cognitive ability and goal orientation. *Journal of Applied Psychology, 90*(6), 1153-1167.

Levine, J. M., & Choi, H. (2004). Impact of personnel turnover on team performance and cognition *Team cognition: Understanding the factors that drive process and performance* (pp. 153-176): American Psychological Association.

Levine, J. M., & Moreland, R. L. (1991). Culture and socialization in work groups. In L. B. Resnick, J. M. Levine & S. D. Teasdale (Eds.), *Perspectives on socially shared cognition* (pp. 257-279). Washington, DC: American Psychological. Association.

Lewis, K., Belliveau, M., Herndon, B., & Keller, J. (2007). Group cognition, membership change, and performance: Investigating the benefits and detriments of collective knowledge. *Organizational Behavior and Human Decision Processes, 103*(2), 159-178. doi: 10.1016/j.obhdp.2007.01.005

Lim, B.-C., & Klein, K. J. (2006). Team mental models and team performance: A field study of the effects of team mental model similarity and accuracy. *Journal of Organizational Behavior, 27*(4), 403-418. doi: 10.1002/job.387

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 83-104. doi: 10.1037/1082-989x.7.1.83

Marks, M. A., Sabella, M. J., Burke, C. S., & Zaccaro, S. J. (2002). The impact of cross-training on team effectiveness. *Journal of Applied Psychology, 87*(1), 3-13. doi: 10.1037/0021-9010.87.1.3

Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. (2000). Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *Journal of Applied Psychology, 85*(6), 971-986.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Cannon-Bowers, J. A., & Salas, E. (2005). Scaling the quality of teammates' mental models: Equifinality and normative comparisons. *Journal of Organizational Behavior, 26*(1), 37-56. doi: 10.1002/job.296

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology, 85*(2), 273-283. doi: 10.1037/0021-9010.85.2.273

Mathieu, J. E., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of Management, 34*(3), 410-476.

Mathieu, J. E., Rapp, T. L., Maynard, M. T., & Mangos, P. M. (2009). Interactive effects of team and task shared mental models as related to air traffic controllers' collective efficacy and effectiveness. *Human Performance, 23*(1), 22-40. doi: 10.1080/08959280903400150

Mclain, D. L. (1993). The Mstat-I: A new measure of an individual's tolerance for ambiguity. *Educational and Psychological Measurement, 53*(1), 183-189. doi: 10.1177/0013164493053001020

Mohammed, S., & Dumville, B. C. (2001). Team mental models in a team knowledge framework: expanding theory and measurement across disciplinary boundaries. *Journal of Organizational Behavior, 22*(2), 89-106. doi: 10.1002/job.86

Moon, H., Hollenbeck, J. R., Humphrey, S. E., Ilgen, D. R., West, B., Ellis, A. P. J., & Porter, C. O. L. H. (2004). Asymmetric adaptability: Dynamic team structures as one-way streets. *Academy of Management Journal, 47*(5), 681-695. doi: 10.2307/20159611

Moreland, R. L. (1999). Transactive memory: Learning who knows what in work groups and organizations. In L. L. Thompson (Ed.), *Shared cognition in organizations: The management of knowledge* (pp. 3-31). Mahway, NJ: Erlbaum.

Moreland, R. L., Argote, L., & Krishnan, R. (1998). Training people to work in groups. In R. S. Tindale & e. al. (Eds.), *Theory and research on small groups* (pp. 37-60). New York: Plenum Press.

Moreland, R. L., & Levine, J. M. (2001). Socialization in organizations and work groups. In M. E. Turner (Ed.), *Groups at work: Theory and research* (pp. 69-112). Mahway, NJ: Lawrence Erlbaum Associates.

Nemeth, C., & Ormiston, M. (2007). Creative idea generation: harmony versus stimulation. *European Journal of Social Psychology, 37*(3), 524-535.

Nieva, V. F., Fleishman, E. A., & Rieck, A. M. (1978). *Team dimensions: Their identity, their measurement, and their relationships*. Rep. 85-12, Washington, DC: ARRO.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, 36*(4), 717-731. doi: 10.3758/bf03206553

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185-227. doi: 10.1080/00273170701341316

Prislin, R., & Christensen, P. (2005). The effects of social change within a group on membership preferences: To leave or not to leave? *Personality and Social Psychology Bulletin, 31*(5), 595-609.

Rentsch, J. R., & Klimoski, R. J. (2001). Why do 'great minds' think alike?: Antecedents of team member schema agreement. *Journal of Organizational Behavior, 22*(2), 107-120. doi: 10.1002/job.81

Resick, C. J., Murase, T., Bedwell, W. L., Sanz, E., Jiménez, M., & DeChurch, L. A. (2010). Mental model metrics and team adaptability: A multi-facet multi-method examination. *Group Dynamics: Theory, Research, and Practice;Group Dynamics: Theory, Research, and Practice, 14*(4), 332-349. doi: 10.1037/a0018822

Rice, D. J., Davidson, B. D., Dannenhoffer, J. F., & Gay, G. K. (2007). Improving the effectiveness of virtual teams by adapting team processes. *Computer Supported Cooperative Work (CSCW), 16*(6), 567-594.

Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C. (2008). Team implicit coordination processes: A team knowledge-based approach. *The Academy of Management Review, 33*(1), 163-184.

Rinke, L. (2011, December 12). [Personal Communication].

Rouse, W. B., Cannon-Bowers, J. A., & Salas, E. (1992). The role of mental models in team performance in complex systems. *IEEE Transactions on Systems, Man, and Cybernetics, 22*, 1296-1308.

Salas, E., Rosen, M. A., Burke, C. S., & Goodwin, G. F. (2009). The wisdom of collectives in organizations: An update of the teamwork competencies. In E. Salas, G. F. Goodwin & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches.* (pp. 39-79). New York, NY US: Routledge/Taylor & Francis Group.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston, MA US: Houghton, Mifflin and Company.

Smith-Jentsch, K. A. (2009). Measuring team-related cognition: The devil is in the details. In E. Salas, G. F. Goodwin & C. S. Burke (Eds.), *Team effectiveness in complex organizations : Cross-disciplinary perspectives and approaches* (pp. 491-508). New York: Routledge/Taylor & Francis Group.

Smith-Jentsch, K. A., Campbell, G. E., Milanovich, D. M., & Reynolds, A. M. (2001). Measuring teamwork mental models to support training needs assessment, development, and evaluation: Two empirical studies. *Journal of Organizational Behavior, 22*(2), 179-194. doi: 10.1002/job.88

Smith-Jentsch, K. A., Cannon-Bowers, J. A., Tannenbaum, S. I., & Salas, E. (2008). Guided team self-correction. *Small Group Research, 39*(3), 303-327. doi: 10.1177/1046496408317794

Smith-Jentsch, K. A., Kraiger, K., Cannon-Bowers, J. A., & Salas, E. (2009). Do familiar teammates request and accept more backup? Transactive memory in air traffic control. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 51*(2), 181-192. doi: 10.1177/0018720809335367

Smith-Jentsch, K. A., Mathieu, J. E., & Kraiger, K. (2005). Investigating linear and interactive effects of shared mental models on safety and efficiency in a field setting. *Journal of Applied Psychology, 90*(3), 523-535. doi: 10.1037/0021-9010.90.3.523

Smith, E. D., & Nyman, R. C. (1939). *Technology & labor: A study of the human problems of labor saving*. New Haven, CT: Yale University Press.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290-312.

Stout, R. J., Cannon-Bowers, J. A., Salas, E., & Milanovich, D. M. (1999). Planning, shared mental models, and coordinated performance: An empirical link Is established. *Human Factors, 41*(1), 61-71. doi: 10.1518/001872099779577273

Summers, J. K. (2009). *Attributions For Team Member Change And The Resulting Flux On Team Coordination Processes And Effectiveness.* Ph.D. Dissertation, The Florida State University.

Sutton, R. I., & Louis, M. R. (1987). How selecting and socializing newcomers influences insiders. *Human Resource Management, 26*(3), 347-361. doi: 10.1002/hrm.3930260304

Tannenbaum, S., Mathieu, J. E., Salas, E., & Cohen, D. (2012). Teams are changing: Are research and practice evolving fast enough? *Industrial and Organizational Psychology, 5*(1), 2-24. doi: 10.1111/j.1754-9434.2011.01396.x

Terreberry, S. (1968). The evolution of organizational environments. *Administrative Science Quarterly, 12*(4), 590-613.

Thompson, M., & Duffy, M. (2003). Is the army stretched too thin? *Time*. Retrieved from http://www.time.com/time/magazine/article/0,9171,1005557,00.html

US Department of Labor Bureau of Labor Statistics. (2011). Mass layoffs-October 2011 Retrieved December 1, 2011, from http://www.bls.gov/news.release/archives/mmls_11222011.pdf

van Offenbeek, M. (2001). Processes and outcomes of team learning. *European Journal of Work and Organizational Psychology, 10*, 303-317.

Vandewalle, D. (1997). Development and validation of a work domain goal orientation instrument. *Educational and Psychological Measurement, 57*(6), 995-1015. doi: 10.1177/0013164497057006009

Waller, M. J. (1999). The timing of adaptive group responses to nonroutine events. *Academy of Management Journal, 42*(2), 127-137.

Waller, M. J., Gupta, N., & Giambatista, R. C. (2004). Effects of adaptive behaviors and shared mental models on control crew performance. *Management Science, 50*(11), 1534-1544.

Webber, S. S., Chen, G., Payne, S. C., Marsh, S. M., & Zaccaro, S. J. (2000). Enhancing Team Mental Model Measurement with Performance Appraisal Practices. *Organizational Research Methods, 3*(4), 307-322. doi: 10.1177/109442810034001

Wegner, D. M. (1986). Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of group behavior* (pp. 185-208). New York: Springer-Verlag.

Weingart, L. R. (1992). Impact of group goals, task component complexity, effort, and planning on group performance. *Journal of Applied Psychology, 77*(5), 682-693. doi: 10.1037/0021-9010.77.5.682

Woolley, A. W. (2009). Means vs. ends: Implications of process and outcome focus for team adaptation and performance. *Organization Science, 20*(3), 500-515. doi: 10.1287/orsc.1080.0382

Ziller, R. C. (1965). Toward a theory of open and closed groups. *Psychological Bulletin, 64*(3), 164-182. doi: 10.1037/h0022390