2013-02-28

Communities of Innovation: Composition, Climate, and Process Variables in Group Innovation

Bradley D. Marianno
Brigham Young University - Provo

Communities of Innovation: Composition, Climate, and Process

Variables in Group Innovation

Bradley D. Marianno

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Science

Marie Cornwall, Chair
Eric Dahlin
Carol Ward
Richard West

Department of Sociology
Brigham Young University
March 2013

ABSTRACT

Communities of Innovation: Composition, Climate, and Process
Variables in Group Innovation

Bradley D. Marianno
Department of Sociology, BYU
Master of Science

Drawing upon the Communities of Innovation (COI) framework, this study seeks to identify the composition (functional demographic diversity), team climate (vision, participatory safety, task orientation, support for innovation), and process (group reflection, group flow, group conflict, dynamic expertise) variables that influence team-level innovation. Using data from 15 business school teams enrolled in a class on innovation and entrepreneurship, I explore the extent to which the proposed composition, team climate, and process variables discriminate between high-ranking and low-ranking innovative teams. I also investigate the degree to which these variables are conceptually and empirically distinct. Given the relative importance of dynamic expertise as a group process, I seek to answer how dynamic expertise is fostered in COIs. Finally, this study seeks to answer the degree to which the proposed composition, team climate, and process variables influence team level innovation.

I found significantly greater levels of vision, participatory safety, support for innovation, group reflection, group flow, and dynamic expertise and significantly lower levels of group conflict in high-ranking innovative teams. No significant differences in levels of task orientation and functional diversity existed. Furthermore, the identified COI elements, particularly the team climate measures, are moderately correlated, suggesting that some elements of the COI are not empirically distinct. I found dynamic expertise to be of particular importance to COIs, and demonstrated that a supportive environment and group flow are particularly important to its development. Finally, results from a multinomial logistic regression model showed that support for innovation, group flow, and dynamic expertise were positively associated with the likelihood of being in a high-ranking innovative team. Implications for the COI framework are discussed.

Keywords: communities of innovation, group process, dynamic expertise, innovation

ACKNOWLEDGEMENTS

First, I would like to express appreciation for my wife and daughter for their love and support throughout the duration of this project. Second, I am appreciative of my thesis committee—Professors Cornwall, Dahlin, Ward, and West—whose encouragement and advice guided this project from its early stages to completion. Professor Cornwall took a particular interest in me as a person, student, and scholar for which I will be forever grateful. Finally, I express appreciation for the innovation and entrepreneurship class members and their professor, who willingly and cooperatively participated in the data collection process.

TABLE OF CONTENTS

Chapter 1-Introduction/Literature Review

Consistent and quality innovation is important for companies to secure and maintain a competitive advantage and achieve long-term viability in today's constantly changing economy (Coakes & Smith, 2007; George, 2008). More frequently organizations are relying on work teams to facilitate the innovation process. As such, innovation in work teams continues to garner a lot of attention from scholars (Bell, Villado, Lukasik, Belau, & Briggs, 2010; Birkinshaw, Bouquet, & Barsoux 2011; Hulsheger, Anderson, & Salgado, 2009; Nemeth & Nemeth, 2003; Post, Lia, Ditomaso, Tirpak, & Borwankar, 2009; Rietzschel, 2011). The purpose of this research is to elaborate on previous innovation frameworks by focusing more closely on the various composition, team climate, and group process variables that foster team innovative output.

A number of frameworks for understanding innovation in work teams have been presented in the past. For example, team innovation is frequently studied within the context of team composition. This approach focuses on the diversity of group members and is founded on the premise that diverse individuals bring to the team a wide range of expertise, skills, experiences, and outside networks that a team can utilize when generating new ideas, solving a problem, or implementing a novel solution (Hülsheger, Anderson, & Salgado, 2009). This approach has been useful for parsing out when and what kind of diverse group characteristics matter in innovative work teams.

Another strain of research focuses specifically on the team climate for innovation. Team climate models emphasize the embeddedness of teams in a larger climate that ultimately has an effect on the team's ability to innovate (Anderson & West, 1998). For example, teams with climates conducive to a shared vision (Mathisen, Martinsen, & Einarsen, 2008) that provide support for innovative ideas (Pirola-Merlo, 2010) tend to be more innovative. Climate studies are useful in that they move past the group composition approach and help outline external group and organizational contextual factors that constrain or boost group innovation.

While useful for understanding the knowledge that teams have at their disposal or the effect that external group factors have on innovation, diversity and climate models often fail to acknowledge the impact group processes have on team innovative output (West & Anderson, 1996; Miliken, Bartel, & Kurtzberg, 2003). Group processes are defined as the interdependent work that teams perform to convert inputs into meaningful outcomes (Marks, Mathieu, and Zaccaro, 2001). They encompass the interactive and collaborative processes inherent in group work and focus on the face-to-face exchanges of group members. Models that only focus on diversity or other group composition variables, or climate variables external to the team, may overlook the effect that interactive group processes have on team innovation.

Another popular framework for understanding team-level innovation, the Input-Process-Output model (IPO), builds on the group composition and climate studies mentioned previously by adding more focus on specific group processes. Specifically, West and Anderson (1996) adapted the IPO model to study team-level innovation as an output. They posited that both group composition and organizational context act as inputs that influence group processes. They identified objective clarity and commitment, group participation, task orientation, and team support for innovation as group processes that transfer group inputs into innovative outputs. While the IPO framework was one of the first to theorize the role that group processes have on the relationship between group inputs like group composition and team climate, and innovation, the identified processes need further development.

This study builds on the IPO Model by drawing upon West and Hannafin's (2011) Communities of Innovation (COI) framework with the purpose of elaborating on the composition, team climate, and group process variables that influence team-level innovation. This framework posits that COIs are distinct communities brought together by shared innovation or the goal of creating something new (West, 2009). In essence, COIs, like the IPO model, are concerned with both the interactive processes of the group innovative experience and the conditions under which these processes are facilitated (e.g. climate and team composition). However, the COI framework provides a more nuanced perspective of the group processes originally presented in West and Anderson's (1996) IPO model by focusing on the processes of *group flow, dynamic expertise, group conflict,* and *group reflection*. Using survey data from sixteen business school teams enrolled in a class on innovation and entrepreneurship, this study seeks to identify what composition, team climate, and group process variables matter in innovative teams by empirically testing the relationship between the variables (composition, climate, and processes) identified in the COI framework and team-level innovation.

Literature Review

The purpose of this study is to provide an empirical test of the COI framework (West, 2009; West & Hannafin, 2011) with hopes of illustrating some of the composition, climate, and group processes variables that facilitate innovative output. First, I will explore previous frameworks for understanding team-level innovation. Second, I will illustrate how the COI framework differs from these previous frameworks and its unique contribution to the study of team innovation. Finally, I will explore in more detail some of the group processes proposed by the COI framework, with a particular focus on the concept of dynamic expertise in an attempt to demonstrate the usefulness of these processes in fostering innovation in the group setting.

Frameworks for Understanding Team Innovation

Teams can be defined as a "collection of individuals who share responsibility for a given outcome" (Bercovitz & Feldman, 2011, p. 82). Specifically, this research focuses on teams that come together with the shared goal of innovating. That is, I focus on teams that work together beyond the generation or brainstorming of novel ideas, to actually develop, and implement these ideas in answer to a given problem (West, 2009). Thus, I define innovation as the introduction of ideas, processes, products or procedures that act as the solutions to the problems of individuals, groups, organizations, or society (West & Wallace, 1991, p. 303). The emphasis is on both the creativity of new ideas and their feasibility and applicability to the problems of a wider population. Naturally, because innovative teams are made up of different individuals, researchers have sought to identify what individual characteristics inhibit or facilitate innovative output in these work groups. The focus of attention is on the composition of the group itself—the right mixes of individuals' backgrounds, personalities, and characteristics that best lead to innovative group performance. As work groups become increasingly diverse, research on the impact of diversity on group performance continues to grow (van Knippenberg & Shippers, 2007).

Team Composition

Team composition has been studied in a number of different ways as researchers seek to identify the most salient individual characteristics that influence innovative output. Composition is often used as a synonym to diversity, and deals with the degree to which individual group members resemble each other on key attributes like gender, age, or work experience (Peretti & Negro, 2007). One useful distinction to categorize the growing number of variables that entail a diverse team is to subsume them into two broad categories: functional diversity or job-specific diversity and demographic diversity (Hulsheger et al., 2009). Functional diversity deals with the beneath-the-surface attributes like job tenure or education (Post et al. 2009) whereas demographic diversity deals with the readily detectable attributes and often assumed traits of an individual like their race, language, or gender (Miliken, Bartel, & Kurtzberg, 2003).

Typical indicators of functional diversity include educational background (Bantel & Jackson, 1989), work experience (Yap, Chai, & Lemaire, 2005), and organizational tenure (Chi, Huang, Lin, 2009). The idea is that the greater the variability of these characteristics in a team, the wider pool of disparate knowledge, experience, and ideas that a team has to draw from when seeking to innovate. As groups combined shared knowledge and reconcile diverse task-specific perspectives, the potential for innovative output increases (Bantel & Jackson, 1989). For this reason, functional diversity has been traditionally viewed as a catalyst for team-level innovation (Yap, Chai, & Lemaire, 2005).

Conversely, research often paints demographic diversity as an inhibitor of innovation in work teams. Typical demographic traits include age, race, and gender (Bell et al. 2010) but may also include characteristics such as language or ethnicity (Miliken, Bartel, & Kurtzberg, 2003). One compelling explanation that results out of this strain of research is that demographic traits like age or gender are more readily assessed by group members (2003), and thus may result in self-categorizations by individuals in the work group (Mannix, 2005). The result is factional lines, whether real or imagined, that divide group members and inhibit the healthy functioning of the group (Gebert, Boerner, Kearney, 2006).

These approaches to conceptualizing diversity and innovation in teams are not without limitations. Unfortunately both approaches, whether using the idea of information-exchange to explain why functional diversity facilitates innovative output or the theory of social categorization to explain why demographic diversity inhibits innovative output, frequently ignore any role that group processes play in the relationship between diversity and innovation (Perretti and Negro, 2007; van Knippenberg & Schippers, 2007). For example, the information-exchange approach is fairly optimistic in that it assumes that the mere availability of disparate knowledge entails that groups will use this knowledge to its productive advantage when innovating. However, in order for that to occur there must be some type of processing of information. In other words, it is not simply the presence of functional diversity that creates productivity, nor is it the simple fact that team members have readily accessible and acknowledged demographic differences that decreases productivity. Task-relevant differences must be recognized, processed, and utilized by team members (van Knippenberg, De Dreu, & Homan, 2004). This suggests that an increased focus on group processes might help parse out some of the inconsistent findings on diversity and group performance outputs like innovation by emphasizing the role that group interaction has in determining how groups leverage their diversity (Mannix, 2005).

Team Climate

Climate studies extend the team composition approach in that they acknowledge that there are factors external to the team that may influence team innovative output. Climate has been defined as "the set of norms, attitudes, and expectations that individuals perceive to operate in a specific social context" (Pirola-Merlo, Hartel, Mann, & Hirst, 2002, p.564). In other words, it's the shared perceptions of the way things *are* in the organization or team (Reichers & Schneider, 1990).

Climate models acknowledge that the context in which teams are embedded have an influence on their innovative potential (Nsenduluka, & Shee, 2007). This approach differs from the group composition approach in that the focus is no longer on identifying the right mix of individuals in innovative teams, but rather on identifying the right environment that will allow innovative groups to flourish. Saleh and Wang (1993) argued that climate is the result of top management's beliefs and expectations and the reward systems they set up to reinforce these beliefs and expectations. The emphasis is on the trickle-down effect of precedents set by the top of the hierarchical structure that then persist throughout the whole organization (Griffin & Mathieu, 1997). Anderson and West (1998) argued that more salient than the general organizational climate is the proximal work group climate as this is where most of the day-to-day work is carried out by team members. Factors like a clearly defined vision (Mathisen, Martinsen, & Einarsen, 2008), support for innovative ideas (Pirola-Merlo, 2010), orientation towards the task, and participatory safety (Burningham & West, 1995) have all been demonstrated to measurably improve work group innovativeness and are focused on in this study.

However, Anderson and West (1998) also acknowledged that for shared perceptions of a team climate to even exist, there must be some interaction among individuals within the proximal work group. This entails again that interactive group processes have a role in determining the influence of team climate on team innovative output. Most climate models, like group composition models, take a "main effects" approach and leave the role of group processes unexplored. This study seeks to explore the relationship of climate in conjunction with a variety of group processes.

Input-Process-Output

The Input-Process-Output (IPO) model builds on the group composition and climate approaches by acknowledging that teams are nested within a greater organizational and team structure that ultimately influences the interrelationships and working of group members and their productivity and output (Cohen & Bailey, 1997). The IPO was originally popularized by

Hackman (1987) and divides team behavior into inputs, processes, and outputs. Inputs consist of individual factors (e.g. member's skills, personality traits), group level factors (e.g. group type, group size) and environmental level factors (e.g. task type, climate) that influence work group processes designed to produce an output (e.g. group satisfaction, performance quality).

The IPO model was later adapted by West and Anderson (1996) to study specific management teams geared towards innovating. They argued that both group composition and climate act as inputs that influence specific group processes that ultimately produce an output in the form of an innovation. First of all, the model is useful in that it theorizes how group processes act in concert with group composition and climate variables to influence team innovativeness. Second, it provides a useful way to classify (e.g. inputs, processes, outputs) and think about the inordinate number of variables that have been studied in relation to team-level innovation (Hulsheger et al., 2009). Third, it acknowledges the effect that team processes have on predicting the magnitude of innovation in work group teams (West & Anderson, 1996); a finding that has been replicated in other studies (Hulsheger et al., 2009)

However, the model has also been heavily scrutinized, particularly for its limited and misleading definition of group processes (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Mathieu, Maynard, Rapp, & Gilson, 2008). Marks et al. (2001) pointed out that group processes are "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing task work to achieve collective goals" (p.357). In essence, they are the means by which the groups exert a *collective influence* (Griffin & Mathieu, 1997) and transfer inputs into outputs in order to reach their full innovative potential (Anderson, De Dreu, & Nijstad, 2004). Specifically, three of the four group processes West and Anderson (1996) use in their IPO model—clarity of team objectives, task orientation, and support for innovation—can hardly be classified as processes using this categorization. Instead, Marks et al. (2001) define these constructs as *emergent states* or a reflection of the teams' "attitudes, values, cognitions, and motivations" (p. 357) rather than processes that entail some sort of group interaction (Ilgen et al. 2005). In sum, given this oversight in the literature, there remains work to do in identifying the actual processes that are at work in innovative work teams.

The COI Framework

Recently, a new framework best suited for understanding the specific nature of communities centered on a shared goal of innovating was proposed (West, 2009; West & Hannafin, 2011). In sum, these are teams structured around the goal of developing something new, whether in the form of a product, solution, or practice. The COI framework is useful in that it builds on team composition, team climate, and IPO models, by increasing the focus on the interdependent work of team members. In other words, it adds more of a focus on the important role of group processes in innovative teams.

Communities of innovation originated from the concept of communities of practice (COP), defined by Wenger and Snyder (2000) as "groups of people informally bound together by shared expertise and passion for a joint enterprise" (p. 139) (e.g. Frontline managers in charge of processing checks at a bank, engineers engaged in deep-water drilling). COPs can be the source of new ideas, but the focus is on the practices and expertise developed in a specific community of members that in turn reinforce the boundaries and stability of that community (West & Hannfin, 2011, p. 2). Conversely, COIs are dynamic and entrepreneurial in nature. They evolve as new problems arise by deemphasizing authority, shifting group member roles, reflecting on prior experiences, and stimulating new perspectives (West, 2009). In essence, while these two frameworks are not necessarily mutually exclusive, the main distinction is on what is shared by the group members—innovation in COI's compared to expertise and practices in COPs (West, 2009).

The Communities of Innovation framework proposes a number of composition, climate, and process variables that may be related to team innovativeness. A number of the elements of the COI framework have been utilized in other studies of team innovativeness, namely diversity (composition), vision, task orientation, psychological safety, and support for innovation (team climate), group conflict, group reflection, and group flow (process). The purpose of this study is to determine which elements of the COI framework, including team composition, team climate, and process variables, influence team innovative output.

Composition/diversity. Combining research previously mentioned on diversity, the COI framework theorizes that diversity (or what Justesen, 2004, termed *innoversity*) is beneficial to innovative communities. COI's, built on shared innovation, are dependent on the knowledge of the community members to propose and develop new ideas. The COI framework takes an information exchange approach, theorizing that the more team members are different in skills and abilities, the more disparate information there is to draw on when seeking to innovate.

Climate. Consistent with the aforementioned research on team climate, the COI framework theorizes that a supportive climate (one that facilitates team member participation, idea sharing, a shared vision etc.) is important to team innovation, particular in the idea generation and selection stage (West, 2009). A supportive climate allows diverse perspectives to be shared and reconciled through mutual support, team effort, and discussion.

Processes.

Group conflict. Jehn (1995) identified two types of conflict present in work groups—task relevant conflict and relationship conflict. Task relevant conflict is defined as "disagreements among group members about the content of the tasks being performed, including differences in viewpoints, ideas, and opinions" (1995, p. 258). Conversely, relationship conflict is defined as "interpersonal incompatibilities among group members, which typically includes tension, animosity, and annoyance among members within a group" (1995, p. 258).

These two types of conflict have a differential effect on innovative output in work teams. Typically, task relevant conflict is associated with an increase in innovativeness of work teams (De Dreu, 2006) as some degree of task conflict facilitates the evaluation of opposing opinions and the exchange of task-relevant information (Hülsheger et al. 2009). Conversely, relationship conflict is associated with lower levels of innovativeness in work teams primarily because relationship conflict disrupts the processing and sharing of information in the group and increases the amount of antagonism and tension between group members. (De Dreu & Weingart, 2003). However, a recent meta-analysis on process variables found these associations to be minimal, suggesting that prior studies differ in the magnitude and direction of the relationship between these types of conflict and innovation. (Hülsheger et al., 2009). Recently, researchers have argued that all conflict is negative in organizations and teams, and that team performance is more dependent on the management of conflict rather than the mere presence of conflict within a team (De Dreu, 2008). Thus, for the purposes of this study I will focus on both the processes of task and relationship conflict as well as group reflexivity to get an idea of how much conflict occurs in innovative teams and how these challenges are managed.

Group reflection. Group reflection or reflexivity is defined as "the extent to which team members collectively reflect upon the team's objectives, strategies and processes as well as their wider organizations and environments, and adapt them accordingly" (West, 2002, p. 376). West argues that the three most critical elements of reflexivity are first, the attention, awareness, and evaluation of the task at hand, second, a detailed careful planning as a result of this evaluation including an analysis of potential pitfalls of the plan, and third, action or goal-directed behavior towards achieving the desired plan (2002, p. 376). These processes of reflexivity allow teams to effectively manage and confront the dynamic demands of group work by taking a moment to assess their progress, evaluate existing challenges, and respond to problems using a carefully thought out plan of action.

Research shows that teams that are able to go through the process of reflecting on their progress, creating new plans, and implementing those plans to address current obstacles are overall more innovative than those who do not (Tjosvold, Tang, & West, 2004). One reason is because the process of reflection allows team members to think about shared knowledge and recombine it to address the current problems at hand (Muller, Herbig, & Petrovic, 2008). This process is especially important for heterogeneous teams, in that participative leaders can guide heterogeneous teams through the process of reflection thereby transferring the wide arrange of knowledge in diverse teams into an innovative product or a solution (Somech, 2006) while avoiding some of the detriments of team conflict associated with diversity. Clearly, group reflection is an important process to the success of team innovation.

Group flow. Flow is defined as a "particular state of heightened consciousness...in which we feel in control of our actions, and in which there is little distinction between self and environment; between stimulus and response; or between, past, present, and future" (Sawyer, 2008, p. 42). In essence, it entails a level of involvement in a given task that allows an individual to lose sense of their surroundings and become completely enveloped in the task (Csikszentmihalyi, 1990). While flow is typically studied as an individual-level predictor of employee well-being, job satisfaction, and performance (Ceja & Navarro, 2011; Quinn, 2005), it is a useful concept for understanding the dynamic interactions of groups, especially groups centered on creativity and innovation (Sawyer, 2008).

Sawyer (2008) gives several example of flow as a process in teams. For example, he mentions how flow is exemplified in pick-up games of basketball played at a Wisconsin YMCA. In these games there is no clock or referees, no coaches or rulebook. All that is left is the "pure, improvised essence of basketball" (p. 41) where teams are required to adjust to the actions of their opponents and work together to obtain a collective goal. The same group improvisation and adjustment occurs in jazz and theater groups as well as in business teams. In essence, group flow can occur in any team where goals are clearly defined, members are concentrating and listening, members have a sense of control and familiarity with the task and are active participants in the group, and are communicating and moving the discussion forward (2007). Thus, I would expect group flow to be an integrative process in innovative teams.

Dynamic expertise. While the aforementioned processes have been studied in relation to team innovative output (though never together), dynamic expertise is a novel concept that remains heavily understudied. One challenge to the study of dynamic of expertise is that no study to data has sought to find a useful and psychometrically validated way to measure the concept. Thus, this research in addition to empirically testing the COI framework, proposes, tests, and validates a nine item dynamic expertise scale. In this section, I explain how dynamic expertise differs from traditional conceptualizations of expertise. Then I outline work on the proposed antecedents to dynamic expertise. Finally, I explore why dynamic expertise as a group process may be important to team-level innovation.

The Development of the Concept of Dynamic Expertise

Early studies of the development of expertise have been criticized for equating years of experience in a given domain with levels of expert performance (Ericsson, 2004, Ericsson, 2005; Ericsson, Krampe, Tesch-Romer, 1993). For example, Chase and Simon (1973), in their seminal study of expert and novice chess players, concluded that expert performance in chess was a function of the slow accumulation of complex situational representations that could be recalled from memory and applied to current games of play. More expert players had put in at least 10 years of experience before they had attained sufficient representations to exhibit expert chess performance (Chase & Simon, 1973). Nonetheless, a number of studies demonstrate a relatively weak relationship between years of experience and expert performance, suggesting that simply "putting in the time" to become an expert does not necessarily lead to expert performance (Camerer & Johnson, 1991; Ericsson, 2008).

To resolve the conflict created by the demonstratively weak relationship between years of experience and expert performance, Ericsson and colleagues proposed the concept of deliberate practice (Ericsson et al., 1993; Ericsson & Lehmann, 1996; Ericsson, 1998). Deliberate practice, put simply, is any activity designed to measurably improve performance in a given domain (Ericsson, 2008). The emphasis is not on the years of experience in a given field but on the quality of the domain-specific experience. In other words, most important is that experience in a given domain is designed and manipulated in such a way to deliberately and efficiently improve performance. A number of studies demonstrate that deliberate practice is associated with domain-specific expert performance (Duvivier et al. 2011; Ford, Ward, Hodges, & Williams, 2009; Kellogg & Whiteford, 2009).

Ericsson's theory of deliberate practice is useful in that it maintains a focus on individuals exerting deliberate efforts to extend their expertise and perform expertly. Such studies suggest that in order to learn the most about experts and the development of expertise, the focus should not be on experts working comfortably within their limits, but on experts functioning at the edge of their competence (Bereiter and Scardmalia, 1993). In fact, some argue that the main distinguishing feature between experts and non-experts is the extent to which they push boundaries and extend their current levels of expertise (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004)—those who fail to do so are appropriately termed "experienced non-experts" (Bereiter & Scardmalia, 1993).

Research that focuses on experts pushing their competence conceptualizes the gaining of expertise as a dynamic process, one that is difficult and replete with significant challenges. Hakkarainen et al. (2004) termed the expertise that results from a continual effort to surpass one's earlier achievements and work at the edge of competence as *dynamic expertise*. The underlying mechanism of dynamic expertise is what Bereiter and Scardmalia (1993) called progressive problem solving—a process characterized by the identification of challenging problems that when addressed require an individual to function at the edge of their competence. Such problems require significant mental exertion, until through sustained effort, solving them allows the individual to reach a level of automaticity where previously tied up mental resources can be reinvested into new, more challenging problems. Thus, the process continues on, effectively allowing an individual to extend their competence by tackling more and more complex and challenging problems.

Antecedents to the Dynamic Development of Expertise

Motivation. Given that the dynamic development of expertise is a mentally taxing exercise (Bereiter and Scardmalia, 1993), certainly, motivation plays an important role in determining whether or not an individual is willing to engage in progressive problem-solving and push the edge of their competence. In other words, not all individuals are predisposed to gain new expertise through tackling challenging problems.

Taking it a step further, Bereiter and Scardmalia (1993) argued that individuals are willing to engage in process of expertise specifically because it feels good to push one's competencies. That is to say that individuals experience strong positive feelings when the problem to be solved adequately matches their ability to solve it. This type of motivational experience, one that results when ability and challenge are synchronously balanced, was termed flow by Csikszentmihalyi (1996). Flow characteristically occurs when individuals are totally absorbed in the task to the point of losing track of time and a feeling of total control of what they are doing. Not only does flow feel good, but Bereiter and Scardmalia (1993) call it "addictively enjoyable," proposing that once experienced, individuals feel motivated to experience it again and again.

Given that flow occurs when one's competencies adequately match what is required by the task, one would expect the flow experience to occur more frequently in situations where individuals are functioning at the edge of their competency (Hakkarainen et al. 2004). Csikszentmihalyi (1996) found that boredom results when what is required by the task at hand is far below the competency of the individual. Furthermore, intense anxiety occurs when what is required by the task far exceeds the competency of the individual. Thus, functioning on the edge of one's competence, having just enough ability to solve the task at hand, should produce the optimal conditions for the flow experience. Furthermore, the flow experience should provide ample motivation for the process of dynamic expertise. While this relationship between flow and dynamic expertise has been proposed, it has never been studied empirically (Bereiter & Scardmalia, 1993; Hakkarainen et al. 2004).

Supportive climate. Another likely determinant of an individual and group's ability to push the edge of their competence is the degree to which the surrounding environment allows for inquisitiveness and exploration. Certainly some climates are more conducive to the searching and solving of challenging problems than others. Bereiter and Scardmalia (1993) term these second-order environments, or environments where the status-quo is constantly changing and individuals are motivated to surpass earlier achievements as a result of the rapid success of others. In these environments, expertise evolves out of necessity because conditions in the environment are constantly in flux. In order to stay relevant one must adapt accordingly. Certainly, this suggests that environments can be engineered to some extent to provide opportunities for progressive problem solving. Hakkarainen et al. (2004) points out the following:

> An organization may support its employees' progressive problem solving in many ways. The organization could allow an individual employee to tailor his or her position in a way that facilitates the dynamic development of expertise and negotiate a way of doing this that fits with the other employee's positions. The congeniality to progressive problem solving requires that a person be provided with a sufficient degree of freedom in his or her work and an opportunity to influence the organization's activity. (p. 48)

In other words, a culture or climate that allows for some degree of autonomy could play an important role in the degree to which individuals dynamically develop expertise. Research demonstrates that teams and organizations that allow for autonomy to take risks and explore new ideas are more innovative than those who do not (Hülsheger et al., 2009). Thus, it is possible that the same climate that is conducive to innovation—a climate of autonomy and support—is also conducive to the dynamic development of expertise. In this study I explore the extent to which supportive climate impacts the dynamic development of expertise by using Anderson and West's (1998) support for innovation scale mentioned previously.

Expertise and Innovation

The extant literature remains largely inconclusive on the impact of expertise on creativity and innovation. One perspective argued by Ericsson (1998, 1999) is that in order for an individual's contributions to be recognized as creative they must meet the acceptable standards of creativity determined by other experts in their domain. In other words, a certain amount of prerequisite knowledge of the domain is required, such that an individual is able to determine what is currently conceived as creative in the field, and be able to surpass that with their own achievements. The garnering of such complex mental representations so as to surpass earlier achievements in the field takes time and is only accomplished through consistent and deliberate practice (Ericsson, 1993). Thus, in this view, expertise is imperative to an individual's ability to be creative as it allows an individual to push the boundaries of their field by using domain-specific knowledge of past creative contributions to generate fresh ideas (Hao, 2010; Reiley, 2008; Weisberg 1998, 2006).

Contrary to this view is the perspective that expertise is in tension with creativity—that while expertise might afford more complex mental representations that can be brought to bear on current problems (Ericsson, 1998, 1999), increases in expertise result in a corresponding decline in flexible thinking (Chi, 2006; Wiley, 1998)—a desirable attribute when seeking to be creative

(Nijstad, De Dreu, Rietzschel, & Baas, 2010). In other words, the amount of domain-specific knowledge one gains does not necessarily correspond with an individual's ability to connect this information in novel ways, particularly when changes in the task or environment demand flexibility and adaptability (Lewandowsky, Little, & Kalish, 2007). As individuals gain more expertise they can become what Dane (2010) termed cognitively entrenched, or demonstrate a high-level of stability in domain-specific schemas (p. 579). Given that some degree of cognitive flexibility is necessary for creativity (Nijstad et al. 2010), cognitive entrenchment as a result of increased expertise is detrimental to expert creative performance (Dane, 2010).

Given that most creative contributions are not solely spontaneous creations, with no ties to previous ideas, products, or procedures, (Amabile, 1998) it would make sense that expertise in a given field would assist in generating creative innovations as Ericsson (1998, 1999) proposes. However, innovations also contain a component that is new and fresh, something unprecedented in the field (Amabile, Conti, Coon, Lazenby, & Herron, 1996), suggesting that the cognitive entrenchment that often results from domain-specific expertise would be stifling to creative contributions—that it would limit one's ability to "think outside the box." Recently, scholars have sought to resolve the creativity/expertise conundrum by proposing that expertise is an important condition for creativity but is by itself not sufficient (Amabile, 1998; Glavaneau, 2012; Simonton, 2003; Weisberg, 2006). Clearly, not all experts exude creativity nor do all experts lack it, suggesting that the question that should be asked is what do creative experts do that non-creative experts do not (Bereiter & Scardmalia, 1993)? In other words, how do some experts avoid cognitive entrenchment while others do not?

I propose that the difference is found in the process by which the expertise is developed. Again, if expertise is conceptualized as a dynamic process rather than a static outcome, fueled by the progressive solving of more challenging problems and seeking expertise in previously underdeveloped areas, then it becomes more difficult to grow comfortable in expertise (Bereiter & Scardmalia, 1993). The identification of progressively harder problems, including those outside of one's domain, is what keeps expertise from "rigidifying"—becoming so stable so as to limit creative thought (Bereiter & Scardmalia, 1993; Dane, 2010). This explanation, if valid, helps explain why some experts exhibit creative performance and others do not, and even why some novices are able to perform creatively without large reserves of expertise. Put simply, it is not a matter of *how much* expertise one has gained but more a matter of *how willing* and *how able* one is to push their competencies and live on the edge.

Purpose and Hypotheses

The purpose of this study is to determine which elements of the COI framework, including team composition, climate, and process variables, influence team innovative output. In pursuit of this objective I seek to answer several research questions. First, I explore the extent to which the proposed composition, climate, and process variables discriminate between high-ranking and low-ranking innovative teams. In other words, are there significant differences in the mean levels of the composition, climate, and process variables between high-ranking innovative teams and low-ranking innovative teams? Second, I explore the degree to which the proposed composition, climate, and process variables are conceptually and empirically distinct. Do the proposed variables exhibit high or low correlations with one another? Third, given the relative importance of dynamic expertise as a group process, I seek to answer how dynamic expertise is fostered in COIs. More specifically, I use an OLS regression model to explore how a supportive environment and group flow predict levels of dynamic expertise. Finally, I seek to answer the degree to which the proposed composition, climate, and process variables influence team level innovation using a multinomial logistic regression model. With these research questions in mind I propose the following hypotheses:

H1: Members of groups ranked as highly innovative will report higher levels of *vision, participatory safety, task orientation, support for innovation, group reflection, group flow, task conflict, dynamic expertise, and functional diversity* then members of groups who are ranked as less innovative.

H2: The proposed composition, climate, and process variables will exhibit low bivariate correlations.

H3: *Support for innovation* and *group flow* will be positively and significantly related to levels of *dynamic expertise* as reported by group members.

H4 *Vision, participatory safety, task orientation, support for innovation, group reflection, group flow, task conflict*, *dynamic expertise,* and *functional diversity* will be positively and significantly related to the odds of being in a high-ranking innovative group.

H5: *Relationship conflict and demographic diversity* will be negatively and significantly related to the odds of being in a high-ranking innovative group.

Chapter 2- Method

Sample and Setting

A survey questionnaire was administered to 15 MBA and undergraduate student teams in the School of Management at a large private Western university, following an elective course on innovation and entrepreneurship. Participation in the study was voluntary, solicited through a brief presentation early in the semester in both the undergraduate and graduate courses. Students were offered a $10 gift card for their participation. In total, 56 individuals responded to the survey, a response rate of 90 percent between the two classes.

During their coursework, students formed teams to generate, develop, and analyze ideas for a new business startup. Throughout the semester these teams spent a significant amount of time brainstorming ideas for new business ventures, spent additional time selecting and refining their idea, performed an in-depth assessment of the targeted market for their new venture, and presented a feasibility report that included steps to implementing their new business plan and likelihood of success of their new idea. As the class focus was on innovation and entrepreneurship, the success or failure of each team depended on its innovativeness.

I attended two group meetings approximately three months into the course to get an idea of the extent to which the composition, climate, and process variables were occurring in these teams. The first group was holding its fourth meeting. Only two students attended the meeting and they both lamented to me how difficult it was to gather all of their team members together (one member had actually switched teams partway through the semester). This team spent the duration of their meeting brainstorming ideas for their innovative business startup, tossing out a new idea and then pausing for several seconds before voicing any critiques. The meeting was fragmented, separated by long pauses of thought and some off topic conversation about wives and the weather. Finally, the team decided on an idea and agreed to resolve the issues surrounding prototyping and analyzing the addressable market by the next week. By my assessment, this meeting was filled with a lot of group reflection and characterized by low levels of conflict, flow, and dynamic expertise. The climate was one of safety, with moderate levels of vision, task orientation, and supportiveness.

In stark contrast to this first group was the second group; a fairly large team of around six graduate students, who, before my scheduled observation, were well on their way to prototyping their new business venture. All team members were in attendance, and shortly after the commencement of the meeting they projected a prototype website on one of the flat screen televisions in the room. Discussion regarding the prototype flowed from one group member to the next. With each comment or critique there seemed to be consensus among the group members regarding the direction of their project, signifying high levels of vision and task orientation and low levels of conflict in the team. I was impressed with how enveloped and invested all of the group members were in the task. It was also apparent that the difficulty of their task was synchronously balanced with the skill level of the group as they divided up the tasks for the next step of their project. Assignments were carefully chosen based on the expertise of the group members. Altogether, group members appeared to enjoy the meeting and their project idea. It was clear to me that this team was involved in the flow experience more than the first group. Even more apparent was that these two observation periods yielded considerably different group experiences among these innovative teams and provided some evidence that the aforementioned composition, climate, and process variables are useful in distinguishing which teams are more and less likely to be innovative.

Independent raters were used to judge the innovativeness of the teams' final business plans, thereby providing an effective way of ranking the teams. Furthermore, using both undergraduate and MBA business students ensured that the sample included teams with a range of domain-relevant experience: some individuals having upwards of 10 years of experience, and others having only a few months; thus I was able to control for the impact of experience on innovation and isolate the effect of dynamic expertise.

Survey Questionnaire

The survey questionnaire was pilot tested for accuracy and validity on a sample of 121 individuals in three undergraduate classes. Minor changes were made to the survey flow based on responses to the pilot survey. The following measures were included (see appendix for all items).

Composition.

Functional diversity. Functional diversity was assessed using one item designed to measure the dissimilarity among team members in the length of time spent (in months) at the job they had worked at the longest. Scores were aggregated at the team level, and then the standard deviation was used in calculating the amount of dissimilarity in job experience. This variable was then logged to correct for skewness.

Demographic diversity. Demographic diversity was assessed using four items that asked about the age, ethnicity, race and gender of each of the team members. The amount of dissimilarity on each of these four categories was calculated for each team. For example, if the team included both males and females, they received a 1 for gender and if they had a Caucasian team member and an African American team member they received another 1. These scores were then summed and divided by the total number of team members to create and overall demographic diversity score, which ranged from 0-.75. A dummy code was then created were teams with a score above .4 were considered demographically diverse (and were coded 1) and teams below .4 were not (and coded zero).

Climate. Climate was measured using Anderson and West's (1998) psychometrically validated Team Climate Inventory (TCI). Rather than overwhelming respondents with the 38-item full version, I utilized the 14-item short version of the TCI, which has shown no significant differences in validity (Kivimaki & Elovainio, 1999; Loo & Loewen, 2002). The TCI consist of the following subscales, all measured on a 5-point Likert scale:

Vision. Vision was measured using four items that focused on the extent to which teams members agreed with and felt that the team's objectives were understandable, worthwhile, and achievable.

Participatory safety. Participatory safety was measured using four items designed to assess the information and idea sharing environment and the level of acceptance among team members.

Task orientation. Task orientation was measured using three items that focused on the extent to which teams members critically appraised and questioned team weaknesses and praised each other for successes.

Support for innovation. Support for innovation was measured using three items designed to measure the extent to which team members took time to develop new ideas.

Processes. In this study I utilized several self-report measures of group process. It should be noted that while the definition of a process clearly identifies it as an event that unfolds over time, most studies of process in the innovation literature utilize self-report measures taken at one point in time. I follow suit with this method, though I acknowledge this as a weakness in the current process/innovation literature.

Reflection. Reflection was measured using Tjosvold, Tang, and West's (2004) measure of task reflexivity. Their measure was adapted from previous research on task reflexivity (Carter & West, 1998) and has shown considerable reliability across studies.

Conflict. Task and relationship conflict was measured using Jehn's (1995) widely used intragroup conflict scale. The scale has been validated across a number of studies and samples (De Dreu, 2006; Dreu & Weingart, 2003)

Flow. Flow was measured using items from Quinn's (2005) study of flow experience in knowledge-work professions. In this study Quinn defined flow as the merging of action and awareness and utilized a four-item scale based on Jackson and Marsh's (1996) Flow State Scale (FSS). Items were scored on a five-point Likert scale.

Dynamic expertise. Dynamic expertise was measured using original items designed for use in this study. To the best of my knowledge, no validated measures of dynamic expertise exist; thus the dynamic expertise scale was carefully crafted as an attempt to create a psychometrically validated measure of the concept. Ten items were generated based on Hakkarainen et al.'s (2004) definition of dynamic expertise as "a kind of expertise that is characterized by a continuous effort to surpass one's earlier achievements and work at the edge of one's competence" (p. 243). In essence, I theorized that the concept of dynamic expertise contains (1) a component consisting of awareness and understanding of a vast array of problems inhibiting the group's success, (2) a component consisting of the identification and pursuit of new and challenging problems, and (3) a component of increased competency consisting of new knowledge and skills in a given domain as a result of pursuing new and challenging problems. Each individual item was scored on a five-point Likert scale.

Control variables. Variation in *team size* among the different groups was included as a control variable. Given the complexity and difficulty of the innovation process, some researchers argue that larger groups have more expertise, skills, and resources to draw upon when innovating (Hülsheger et al., 2009). Thus in order to isolate the relationship between composition, climate, and process variables and team innovation, I controlled for the number of individuals in each group.

As mentioned previously, when predicting dynamic expertise I also controlled for *experience* in a given domain. Most MBA students are older than undergraduates, being required to work at least three years prior to applying to the program, so I used a dummy variable for whether or not an individual was an *MBA student* (coded 1=MBA student, 0=undergraduate student) as proxy for experience in a given domain.

Assessment of the Innovativeness of the Team Projects

One approach to measuring innovation is to utilize self-report survey items (Anderson, De Dreu, & Nijstad 2004; Janssen, 2001). The problem with utilizing self-reports of innovation as well as self-reports of antecedents to innovation (e.g., dynamic expertise) is that the relationship between innovation and the antecedents tends to be inflated, especially when both are assessed on the same survey tool (Hülsheger et al., 2009). This inflation is mainly due to response bias and to individuals seeking congruence between their assessment of innovation and their assessment of the associated processes proposed to correlate with innovation (Hülsheger et al., 2009). Thus some have argued that researchers should move away from self-report items and focus more on independent ratings of innovation (Anderson, De Dreu, & Nijstad, 2004). In this study, I followed this guidance and asked three independent judges to assess the innovativeness of the MBA teams.

The rating process was based on Amabile's (1983) consensual assessment technique, originally used in studies on team creativity (Shalley, 1995). This technique uses ratings from independent judges (experts in a given domain) to assess the creativity of a given product based on their own subjective definitions of creativity (Amabile, 1983). The consensual assessment technique served as a guide to assist in the rating of the teams' projects. While some deviations from Amabile's technique occurred, the three independent ratings of innovativeness correlated at .839, .779, and .757 respectively, suggesting a relatively strong consensus among the three independent raters as to which teams were the most and least innovative. In fact, all three raters chose the same five teams as the most innovative, though in a different order.

This processes differed from Amabile's in a few ways. First, the consensual assessment technique requires that all judges be experts in the field of the products being analyzed. In this case one expert judge and two student research assistants rated the finished business plans. Second, the consensual assessment technique requires that all judges rate the products based on their own subjective definition of creativity. In this case, judges were requested to rate each business plan from 1 to 10 on three subscales: the novelty of the business plan, its significance to society, and its ability to be implemented. While the categories provided some structure to the rating system, individual raters still relied on their own subjective definitions of what is *novel*, *significant*, and *implementable*. Nothing beyond this basic rating procedure was discussed among the judges. Third, the consensual assessment technique requires that each product be viewed in a randomized order for each judge. Such randomization was not feasible in this analysis since the business presentations were being viewed in real time. Finally, the consensual assessment technique requires that the conditions under which the creative products are produced be constant for all participants. The dynamics of group work, especially group work that occurs over the course of a semester, makes holding all conditions constant implausible; however, recent empirical work suggests that the technique works fairly well even when conditions are not held constant (Baer, Kaufman, & Gentile, 2004).

Analytic Strategy

Using the independent ratings of the innovativeness of their projects, groups were ranked from 1 to 15 (one being the most innovative). Groups were classified further by assigning the top five teams to the high-ranking innovative group, the middle five teams to the middle ranking innovative group, and the bottom five teams to the low-ranking innovative group.

My analytic strategy consisted of five stages. First, all scales were validated using factor analysis from a combined sample of the innovation class and the pilot survey group (with the exception of the dynamic expertise scale, which was validated using principal component factor analysis on only the innovation class sample). Once the scales were validated, items were summed to create the measures (with the exception of the reflection scale, for which a factor score was used because of missing data on two individuals). Second, two sample t-tests were utilized to investigate whether the mean reported levels of the composition, climate, and process variables discriminated between high-ranking and low-ranking innovative teams. Third, a bivariate correlation matrix was used to explore whether the proposed composition, climate, and process variables were empirically distinct. Fourth, individual responses on the dynamic expertise scale were treated as continuous and normally distributed, and an ordinary least squares regression model was used to investigate how well a supportive environment and group flow predict levels of dynamic expertise. Finally, a multionomial logistic regression model was utilized to explore the relationship between the proposed composition, climate, and process variables and the odds of being in a high-ranking innovative team.

A multinomial logistic regression model was favorable for this study for several reasons. First, because the innovation ranking variable could be considered ordinal (high, medium, low), I explored using an ordered logistic regression model. However, this model assumes that the odds are equal when moving from one category to the next; because this assumption was violated, I felt that the multinomial logistic model was the best alternative (Hoffmann, 2004). Second, given that I treat the innovation ranking variable as unordered, it might seem plausible to recode the outcome variable and run a series of logistic regression models; however, comparing across models would be difficult due to the different sample sizes of each of the models. Thus the multinomial logistic regression model was more appropriate for this reason as well. Third, it was also sensible to employ a model that allowed use of all 56 cases rather than to sum all measures at the group level. Any group-level analysis would limit the sample to only 15 cases. For these reasons, the multinomial logistic regression model was the best option.

Chapter 3- Results

Table 1 shows descriptive statistics on all composition, climate, and process variables.

Scale Validation

Climate. Exploratory factor analysis was performed on all four climate scales (vision, participatory safety, task orientation, and support for innovation). Results are presented in tables 2-5. Results demonstrate that vision and support for innovation showed relatively strong reliability in this sample, while task orientation and participatory safety were not as strong. More specifically, vision and support for innovation had alpha reliability coefficients of .760 and .761 respectively, and all indicators on both scales loaded strongly onto factor 1 with correlations above .5. Participatory safety and task orientation demonstrated alpha reliability coefficients of .656 and .681 respectively, and all indicators on both scales loaded onto one factor 1 with correlations above .4.

Process. Exploratory factor analysis on the task and relationship conflict scales was slightly more challenging (see table 6). Results reveal a strong single factor structure, suggesting that distinguishing between task and relationship conflict in this sample is implausible. The conflict scale had an alpha reliability coefficient of .870 and all conflict indicators loaded on the first factor with correlations above .6. In sum, hypothesis 1 had to be modified in light of an inability to distinguish between task and relationship conflict in this sample.

Exploratory factor analysis on the reflection scale yielded a surprising two-factor structure (see table 7). The first 5 items of the reflection scale (focusing on team communication) loaded on the first factor with correlations above .4. The last four items (focusing on modifying objectives and openness to new ways of working) loaded onto a second factor with correlations above .4. Nonetheless, the alpha reliability coefficient for the full scale was .834, suggesting that the two factors could be reliably combined into a single scale.

Exploratory factor analysis on the flow scale yielded a single factor structure, somewhat contradicting the results of Quinn (2005). In other words, in this sample there was not a meaningful and measurable separation between the flow experience and the consequences of the flow experience as Quinn suggested (see Table 8). Exploratory factor analysis revealed that most indicators of flow loaded on factor 1 with correlations of .5 or higher. I dropped two indicators, one that measured loss of self-consciousness and the other that measured transformation of time, as they did not load well onto any factor. Analysis on the alpha reliability score supported keeping in item 2 despite its factor 1 correlation of .364. Dropping the item did not measurably improve the alpha reliability of the scale, which was .748.

Finally, principal component factor analysis revealed a three-factor structure in the dynamic expertise scale (see Table 9). Factor 1 included four items, all of which focused on being aware of and understanding how to help the group succeed; it had an Eigenvalue of 2.564. Factor 2, which had an Eigenvalue of 1.924, consisted of three items, all of which focused on gaining new competencies both related and unrelated to one's field of expertise. Factor 3, which revealed an Eigenvalue of 1.427, consisted of two items, both focused on identifying challenging problems. Item 10 was dropped because it did not load well onto any factor. I termed these subscales Developing Awareness and Understanding, Gaining New Competencies, and Pursuing More Challenging Problems.

Analysis of Mean Difference between High-ranking and Low-ranking Innovative Teams

Two sample t-tests were used to test whether the mean reported levels of the composition, climate, and process variables discriminated between high-ranking and low-ranking innovative teams (hypothesis 1). Results yielded strong support for most aspects of hypothesis 1 (see Table 10). Specifically, results from t-tests demonstrates statistically significant and higher reported average levels of vision, participatory safety, support for innovation, group reflection, group flow, and dynamic expertise by members of teams ranked as highly innovative compared to less innovative teams. While I could not distinguish between task and relationship conflict, results demonstrated statistically lower mean levels of conflict in high-ranking innovative teams in comparison to low-ranking innovative teams. There was not a significant difference in mean levels of task orientation or functional diversity between high-ranking and low-ranking innovative teams, demonstrating that task orientation and functional diversity do not differentiate between high-ranking and low-ranking innovative teams as hypothesized.

Empirical Distinctness of Composition, Climate, and Process Variables

In order to test the empirical distinctness of the composition, climate, and process variables, I employed a simple bivariate correlation matrix (see Table 11). Hypothesis 2, that all COI variables are empirically distinct, is not supported as some scales are highly correlated. While this has important implications conceptually for the COI framework (see discussion section), here I deal with the implications methodologically.

First, the climate variables (participatory safety, task orientation, vision, and support for innovation) appear to be highly correlated with one another. More specifically, participatory safety is correlated with vision and support for innovation at .50 and .42 respectively, task orientation is correlated with support for innovation at .62, and vision is correlated with support for innovation at .51. Furthermore, the climate variables were also highly correlated with some of the process variables. For example, vision was correlated with dynamic expertise a .61 and group flow at .54. Given concerns of multicollinearity in the multinomial logistic model, I used only the support for innovation variable as a measure for supportive climate in these innovative teams.

Second, some of the process variables were also highly correlated with one another. The high correlation between dynamic expertise and group flow was of particular concern (.68); however when these variables are run in an OLS regression model, the variance inflation factor was not overly concerning, and when run in the multinomial logistic model both p-values for the group flow and dynamic expertise were statistically significant. Thus, I felt justified keeping both variables in the final model. Reflection had missing data that made placing the variable in the model problematic given the small sample size, so this variable was left out of the final model. Furthermore, conflict appeared to have no significant impact on innovation in the multinomial logistic model, so it was also dropped from the model for parsimony

OLS Regression Model Predicting Dynamic Expertise

In order to test the relationship between supportive environment, group flow, and dynamic expertise, I used an ordinary least squares regression model. Table 12 presents results. I found support for hypothesis 3, that flow and support for innovation would be positively and significantly related to self-reported levels of dynamic expertise. Model 2 demonstrates that every 1-unit increase in flow was associated with a .804 unit increase in levels of dynamic expertise, when statistically adjusting for the effect of support for innovation on dynamic expertise. Support for innovation was positively and significantly related to levels of dynamic expertise. More specifically, every 1-unit increase in support for innovation was associated with a .961 unit increase in levels of dynamic expertise in Model 1. When statistically adjusting for the effect of flow, every 1-unit increase in support for innovation was associated with a .472 unit increase in dynamic expertise, though this effect was non-significant. Model 2 accounts for 49 percent of the variation in individual dynamic expertise scores.

Multinomial Logistic Model Predicting Odds of being in an Innovative Team

In order to explore the relationship between the proposed composition, climate, and process variables on the odds of being in a high-ranking innovative team, I used a multinomial logistic regression model. Table 13 presents the results using the middle ranking innovative group as a comparison to predict the odds of an individual being in a high-ranking or low-ranking innovative group based on their team's demographic and functional diversity and his or her own self-reported levels of support for innovation, flow, and dynamic expertise. The coefficients are interpreted in terms of relative risk ratios (RRR). Model 1 presents the results for demographic and functional diversity, demonstrating that both types of diversity fail to have a significant impact on the odds of an individual being in an innovative group.

Model 2 presents the results for support for innovation on innovation, suggesting that every 1-unit increase in supportive environment is associated with a 62 percent increase in the odds of an individual being in a high-ranking innovative group, when controlling for both types of diversity and group size. This is supportive of hypothesis 4 that support for innovation will be significantly and positively related to the odds that an individual is in a high-ranking innovative team.

Model 3 demonstrates the relationship between group flow and innovation, showing that every 1-unit increase in flow was associated with a 68 percent increase in the odds of an individual being in a high-ranking innovative group when controlling for support for innovation, group size, and both types of diversity. Hypothesis 9 is supported in that group flow is significantly and positively related to the odds of being in an innovative team. However, lower levels of group flow were not significantly associated with increased odds of being in a low-ranking innovative group. Furthermore, the significant effect of support for innovation on the odds of being in an innovative team is lost, suggesting that the relationship between supportive environment and innovation might be mediated by group flow.

The full model presented in Model 4 demonstrates the relationship between dynamic expertise and the odds of being in a high-ranking innovative group. Specifically, every 1-unit increase in dynamic expertise is associated with a 24 percent increase in the odds of being in a high-ranking innovative group, when statistically adjusting for the other variables in the model, thus providing further support for hypothesis 8. However, levels of dynamic expertise appear to have no significant effect on the odds of being in a low-ranking innovative group, suggesting that this phenomenon operates when predicting high levels of innovation but not low levels of innovation. The significant effect for flow on innovation is retained in Model 4, demonstrating that every one unit increase in flow is associated with a 43 percent increase in dynamic expertise.

Chapter 4-Discussion/Conclusion

The results provide some evidence that composition, climate, and process matter in team-level innovation. First, the climate (vision, participatory safety, and support for innovation) and process (group reflection, group conflict, group flow, and dynamic expertise) variables discriminated between high- and low-ranking innovative teams. Members of high-ranking innovative teams reported significantly greater levels of vision, participatory safety, support for innovation, group reflection, group flow, and dynamic expertise, and significantly lower levels of group conflict. Members of high- and low-ranking innovative teams reported the same level of task orientation and functional diversity. Second, results demonstrated significant empirical overlap between a number of the climate and process variables. Third, support for innovation and group flow were strongly related to reported levels of dynamic expertise. Finally, results demonstrated that a supportive climate, group flow, and dynamic expertise were significantly related to the odds of being in a high-ranking innovative team. These results have important implications for the Communities of Innovation framework moving forward.

COI Variables that Matter in Team-level Innovation

Composition. Consistent with a number of studies, the Communities of Innovation framework emphasizes the need for diverse perspectives when seeking to innovate (West, 2009). In this study, I used diversity in functional background (e.g. education, work experience, and job tenure) among community members as an indicator of diversity in perspectives in the teams. Differences in functional diversity between high and low innovative teams were not significant. Furthermore, functional and demographic diversity did not significantly increase the odds of being in an innovative team.

There are a few possible explanations for these findings: It may be the case that functional diversity and demographic diversity simply have no influence on innovation, though this is contrary to what most other studies have found (Bell et al., 2010, Chi et al. 2009; Post et al. 2009). A more likely explanation is that the business school from which this sample was drawn is fairly homogeneous in both functional experience and demographic traits; thus, there was little variance in functional and demographic diversity from which to draw meaningful distinctions between high-ranking and low-ranking innovative teams. Another plausible explanation is that had the measures of diversity been more precise, I may have found a significant effect.

One possible reason for the impreciseness of the measures is that demographic and functional diversity are poor proxies for other types of diversity that exhibit more direct effects on team-level innovation. For example, Van Knippenberg and Schippers (2007) argue that demographic and functional diversity are often used in proxy of more meaningful (though understudied) types of diversity, such as group cognition or affect. Cognition deals with the amount of sharedness among team members in conceptualizations regarding the work being done, and affect has to do with similarity in moods and emotion. Van Knippenberg and Shippers (2007) point out that in order to understand demographic or functional diversity, researchers may need to understand the underlying psychological differences that results when these types of diversity are present in work groups. A broader study of cognition, affect, and other types of diversity that occur when functional and demographic diversity are present in teams could help in clarifying the relationship between functional and demographic diversity and innovation.

In addition, I may have had more success in parsing out the relationship between team composition and innovation had I focused more on the outcomes of diversity and innovation rather than solely diversity by itself. In other words, demographic diversity is often seen as an inhibitor to innovation, primarily because it increases the amount of social categorization that occurs among team members (Gebert, Boerner, Kearney, 2006). Thus, had a direct measure of social categorization been used, the negative relationship between demographic diversity and innovation may have been distinguishable. Furthermore, functional diversity is theorized to measurably improve innovation, because it increases the amount of disparate knowledge available for innovation (Bantel & Jackson, 1989). Had a measure of the amount of task-relevant knowledge in a given team been utilized, the positive relationship between functional diversity and innovation may have been clearer.

Implications for the COI framework. The findings on team composition, specifically those relating to functional diversity, suggest a few implications for the Communities of Innovation framework. First, while the COI framework suggests that diverse perspectives facilitate innovation in these communities, it is unclear how this type of diversity should actually be operationalized in a practical sense. In this research I focused specifically on diversity in job tenure, a commonly-used approach to measure functional diversity, and find no effect on innovativeness. However, other types of functional experience such as education or job type or other types of diversity such as group cognition or affect might also facilitate diverse perspectives in a group and be more related to innovativeness than the measure used in this study. Perhaps more upfront work needs to be done in the COI framework to theorize what types of diversity help facilitate different perspectives and ideas in these innovative communities. Second, perhaps more useful would be to develop an approach that directly measures diversity in perspectives and ideas rather than use functional diversity as a rough proxy. In other words, the assumption is commonly made the diversity in functional experience and background entails that a team will have a diversity of perspectives to draw upon, which then facilitates the innovation; however, such a measure is one step removed from the phenomena of interest. Even more useful would be to develop a direct measure of diversity in perspectives and link that with team innovative output.

Team climate. Similar to other frameworks, the COI framework theorizes that a supportive team climate (one that facilitates team member participation, idea sharing, a shared vision, etc.) is important to team innovation (West, 2009). In particular, a supportive team climate allows diverse perspectives to be shared and reconciled through mutual support, team effort, and discussion. In this study, members of high-ranking innovative teams reported significantly higher levels of vision, participatory safety, and support for innovation but did not report high levels of task orientation. Because the climate measures were highly correlated with one another, only the support for innovation subscale was included in the multinomial logistic regression model. Support for innovation was associated with increased odds of being in a high-ranking innovative team.

Moderate to high inter-correlations between the TCI measures is not new and more attention needs to be given to this issue. A recent study of the Team Climate Inventory found the inventory's different components (e.g. participatory safety, task orientation, vision, and support for innovation) are moderately correlated, but the authors made the argument that the items should be kept separate for practical reasons (Tseng, Lui, & West, 2009). Even in Anderson and West's (1998) original review of the TCI, the inter-correlations were between .35 and .62 (consistent with what was found in this study), though this finding is often ignored under the guise of a need for facet-specific measures of team climate. While the inter-correlation between components of the TCI has been touched on briefly in some review pieces (Mathisen & Einarsen, 2004), most studies tout the reliability and validity of the TCI for assessing climate while ignoring the larger practical issues of assessing the different elements of the TCI in a single regression model. Unfortunately, the need for facet-specific climate measures have led to an over exuberance for the TCI, without much thought for its improvement and further development since Anderson and West's (1998) first review of the inventory.

Authors are, therefore, required to work around this issue when using the TCI measures. For example, some studies on innovativeness have focused on all four components of the TCI but analyzed them separately (as done in this study), used only bivariate correlations instead of a more complex multivariate analysis (Burningham & West, 1995; Loewen & Loo, 2004), or took an average of the four TCI scales (Pirola-Merlo, 2010). Given that most researchers have to work around the issue of high inter-correlations between scale measures, it may not make practical sense to use the TCI when trying to distinguish between the four team climate elements in innovation research as Tseng, Lui, and West (2009) suggest. The argument could be made as to whether or not the TCI elements are as facet-specific as Anderson and West (1998) make them out to be. Certainly this study demonstrates that their conceptual and empirical distinctness should be called into question.

Implications for the COI framework. The findings on climate effects suggest some important implications for the COI framework. First, if the COI framework is concerned primarily with the supportiveness of the climate then the TCI's support for innovation subscale may be an adequate measure; however, the COI framework also focuses on the need for participation and interdependence among team members, suggesting that participatory safety, vision, and task orientation are also important climate elements of a COI. Given the importance of these elements to COIs, it may be important to identify other existing climate measures for these elements that may be more empirically discriminate then the TCI measures (see Mathisen & Einarsen, 2004 for a review of existing climate measures). Another option is to use a more complex modeling technique like SEM, where correlations between error variances can be taken into account. This was not feasible in this study because of the small sample.

Process. Group processes, or the interdependent work performed by group members (Marks et al. 2001), are important to COIs. The COI framework theorizes that group reflection, group flow, group conflict, and dynamic expertise are particularly important to innovation.

Reflection. This study's findings on group reflection are consistent with other studies (Muller, Herbig, & Petrovic, 2008; Tjosvold, Tang, & West, 2004) and support the proposition that reflection may be an integral process of the COI framework. In particular, I found that high-ranking teams reported higher levels of reflection than low-ranking teams. However, reflection was moderately correlated with dynamic expertise, suggesting that the two processes may be related to one another. In some ways it is not surprising the reflection is related to dynamic expertise. Dynamic expertise, which is about the awareness, understanding, and pursuit of challenging problems to gain new competencies, requires that individuals constantly process and think about their team experience so as to more effectively identify the problems needing solving. In other words, only through a process of reflection can individuals properly identify and pursue problems that will allow them to push their competencies and gain new expertise.

Conflict. This study's findings on conflict are interesting in light of what others have found on the relationship between conflict and innovativeness. Exploratory factor analysis yielded support for combining the two types of conflict into a single conflict measure; thus, I could not distinguish between task and relationship conflict using Jehn's (1995) measures. Surprisingly, low-ranking innovative teams had higher levels of conflict, suggesting a possible relationship between any type of conflict and lower levels of innovation. However, there was no significant effect between conflict and innovation in the multinomial logistic regression model.

These findings, while not fully conclusive, have important implications for the role of conflict in COIs. First, recent research suggests that positive benefits of conflict only occur in a limited number of situations under a constrained set of conditions, and that most conflict is indeed detrimental to a team's innovativeness (De Dreu, 2008). This study yields some support for this conclusion. Perhaps more important than the mere presence of conflict in a team (whether task-related or relational), is a team's ability to actively manage that conflict and turn it into productive outcomes. Important to properly functioning COIs then would be an ability to actively manage conflict levels before they become toxic to the community's functioning. Second, given this study of COIs occurred in a classroom setting centered around a class project on innovation, it is highly plausible that teams with more conflict were less innovative because team members participated less in the team in order to avoid uncomfortable situations. Thus, conflict may be related to other types of elements in a COI, such as team member participation, which could influence innovation.

Group flow. This study also yields interesting findings regarding the flow experience. Factor analysis was performed on Quinn's (2005) flow scale which argues that flow, or the merging of action and awareness, can be separately and distinctly measured from the consequences of the flow experience (i.e. concentration, sense of control, autotelic experience, loss of self-consciousness, and transformation of time). This is in contrast to Csikszentmihalyi's (1990) holistic model, which does not separate the flow experience from the consequences of the flow experience. Results show little support for Quinn's (2005) model of the flow experience and yielded some support that flow is more of a holistic experience, involving the merging of action and awareness as well as the other aforementioned consequences. In particular, I found it hard to distinguish through factor analysis between Quinn's (2005) "merging of action and awareness" subscale and his autoletic experience and sense of control subscales in this sample. This suggests that the flow experience may be as much about the merging of action and awareness as it is about feeling in total control and experience complete enjoyment of the experience.

Understanding of the relationship between the flow experience and innovation in COI's and other group settings to this point has been limited (Sawyer, 2008; West, 2009; West & Hannafin, 2010). I demonstrate that high-ranking innovative teams had higher reported levels of the flow experience. Furthermore, I demonstrated that levels of flow are positively and significantly related to the odds of being in a high innovative team, lending support to what previously has been proposed about group flow and innovation (Sawyer, 2008; West & Hannfain, 2010). Still, little is known about the nature of the group flow experience (West, 2009). For example, is group flow harder or easier to achieve in larger groups? How long does the flow experience typically last, and does the duration of the experience have an impact on magnitude of team innovativeness? Does group flow facilitate a particular part of the innovation process (e.g. idea generation) more than other parts? While this study has taken a step to document the relationship between flow and innovation in COI's, answers to these questions could shed further light on how the flow experience is related to innovativeness.

Dynamic expertise. Finally, this study has added to general knowledge of the concept of dynamic expertise and its role in COIs in fostering innovation. Principal component factor analysis on the dynamic expertise scale revealed a three-factor structure, indicating that the dynamic expertise measure consisted of three sub-scales—Developing Awareness and

Understanding, Pursuing Challenging Problems, and Gaining New Competencies. High-ranking innovative teams reported significantly higher levels of dynamic expertise then low-ranking innovative teams. Furthermore, an exploration of the theorized predictors of dynamic expertise demonstrated the positive and significant impacts that a supportive environment and flow have on levels of dynamic expertise. Finally, levels of dynamic expertise were positively and significantly related to the likelihood of being in a high-ranking innovative group.

These findings demonstrate that dynamic expertise is important to team-level innovation and it is an integral part of the COI framework. Beyond demonstrating its usefulness to COIs, this study adds to general knowledge of dynamic expertise as a process. Results demonstrate that dynamic expertise consists of the awareness, understanding, and careful selection of challenging problems that lead to new competencies. It should not be surprising that a process driven by the pursuit of progressively harder problems (Hakkarainen et al., 2004) requires that individuals be aware of and understand the vast array of problems facing them or their group. When aware, they may be more apt to select a challenging problem that will allow them to surpass their current levels of expertise. Going a step farther, one characteristic that distinguishes experts from non-experts is the extent to which they actually choose to pursue challenging problems to develop new competencies (Bereiter & Scardamalia, 1993). Thus, experts go beyond awareness and understanding of challenging problems to actively pursue solutions.

This distinction suggests that if organizations want to facilitate dynamic expertise, they might assist employees in identifying and exploring challenging problems. More specifically, results demonstrate the importance of a supportive environment in facilitating dynamic expertise. As mentioned previously, engaging progressively harder problems is a strenuous exercise, characterized by risk and potential for failure (Bereiter & Scardamalia, 1993). Thus, the process of dynamic expertise depends somewhat on the amount of latitude individuals have to engage problems that may not always lead to successful outcomes. In essence, the dynamic development of expertise is as much about learning from success as it is about learning from failure, as productive learning can occur in both situations (Kapur, 2008). Therefore, organizations might support the pursuit of productive and progressively harder problems by incentivizing risky problem exploration. Furthermore, organizations can develop ways for employees to evaluate and reflect on new challenges that could be undertaken to further the mission of the organization and help the employee gain new expertise.

Organizations might support the pursuit of challenging problems in a few other ways. First, organizations might consider giving employees more control over the tasks they undertake, allowing at least some time for employees to select and pursue problems they choose themselves. Consider the elegant solution, originally named the "15 percent rule," which is used in some form by companies such as 3M, W.L. Gore, Google, and Hewlett Packard. This rule allows employees to use some of their time to pursue any project that they feel might be beneficial to the company. Or consider Pixar's strategy of encouraging all employees to attend four hours of in-house course offerings of their choice that may or may not be related to their area of expertise. In sum, both solutions support the pursuit of challenging problems by giving employees ownership over the types of challenges they face at work and send the message that the development of new competencies is important to the organization. Second, besides allowing employees time to autonomously pursue challenging problems, organizations might consider the nature of the tasks they assign. In order to drive the process of dynamic expertise, individuals must tackle problems that are both challenging and solvable—problems that are just outside the boundaries of their expertise. Enabling this entails careful work upfront by managers to match employees with challenging tasks—tasks that are just demanding enough to ensure that employees do not grow comfortable in their expertise. In these ways, organizations can create a supportive environment for developing dynamic expertise.

Beyond organizational support for the dynamic development of expertise, the results suggest that individual motivation is also an integral part of this process. In particular, the flow experience is an important motivator to engaging and re-engaging in identifying and pursuing challenging problems. Flow, which results from "circumstances that are perceived as both problematic and soluble" (Mitchell 1988) brings about intense feelings of enjoyment, total absorption in the task, and a loss of self-consciousness (Csikszentmihalyi, 1996). Dynamic expertise, which includes working at the edge of competency, may include just the right mix of challenge and ability in order to induce the flow experience. Naturally, then, individuals engaging in the process of dynamic expertise may experience feelings of enjoyment, total absorption in the task, and a loss of self-consciousness, finding the process so "addictively enjoyable" that they desire to engage in it again and again (Bereiter & Scardamalia, 1993).

Flow and dynamic expertise may be related for a few other reasons. First, individuals experiencing flow may become so absorbed in the task that they become more acutely aware of all of the various problems needing to be solved. This type of focus may allow them to choose the most challenging and pertinent of problems, thus facilitating the dynamic development of expertise. Second, any fear of failure at tackling challenging problems may be overwhelmed by the loss of self-consciousness associated with the flow experience, during which personal inhibitions do not reach a conscious awareness. As the process of dynamic expertise is associated with feelings of flow, organizations need not be so concerned about how to engage employees in this process, due to the intense enjoyment that comes when expanding one's competencies.

Furthermore, organizations should encourage flow opportunities for employees by being flexible in work arrangements, scheduling, and task management.

Finally, I demonstrate that dynamic expertise is significantly related to innovation. As mentioned previously, recent studies have suggested that expertise and innovation cannot coexist, that expertise is stifling to creative thought (Chi, 2006; Wiley, 1998). However, these studies have conceptualized expertise as a static outcome, a summation of all the domain-specific knowledge of an individual that can be brought to bear on current problems. This study reveals the usefulness of conceptualizing expertise as a dynamic process, demonstrating that the dynamic development of expertise actually facilitates innovative output. This finding suggests that an organization with the overarching goal of fostering creativity and innovation might focus less on getting the right mix of individual experts together in order to innovate and more on engineering the company environment to foster dynamic expertise among employees.

Suggestions for Future Research

This research suggests some important avenues for future research. First, this research suggests that more work needs to be done in the COI framework to posit what measures of diversity best indicated diversity in perspectives within teams. Future research should explore other types of functional diversity, including education and job type and how they influence team innovation. Future research on the COI should also develop a direct measure of diversity in perspectives and link that with team innovative output rather than use functional diversity as an indicator. Second, this study demonstrated that the TCI climate measures are highly correlated with one another. Future research on the COI framework should explore using different climate measures or more complex analytic techniques (e.g. SEM) that can take into account the correlation between climate facets to better assess the role of supportive climates in COIs. Third, this study demonstrated that group reflection was important to innovativeness; however, I also showed that reflection was highly correlated with other group processes, including dynamic expertise. Future research on COIs should continue to explore the relationship between group reflection and dynamic expertise. Fourth, I found mixed support for the relationship between conflict and innovativeness. Future research on COIs should further explore this relationship by analyzing the impact of conflict on community member participation and whether or not conflict management is important to the healthy functioning of a COI. Finally, results on group flow suggest that group flow is as much about the merging of action and awareness as it is about some of the outcomes of the flow experience, contrary to what Quinn (2005) suggests. Future research on the COI should continue to test Quinn's proposition that the flow experience is separate and distinct from the outcomes of the flow experience.

Limitations

This study has a few limitations that might also be addressed in future research. First, this study on the composition, climate, and process variables proposed by the COI and associated with team-level innovation was undertaken using a relatively homogeneous sample (88 percent male, 95 percent white, 93 percent university business majors). Future research should further explore these COI elements with and validate my dynamic expertise measure with other populations. Second, reflexive measures were used to encapsulate the process of group reflection, group flow, group conflict and dynamic expertise across a university semester. This approach has its weaknesses when attempting to measure process variables, which are best studied as they unfold over time (Van de Ven, 2007). Particularly useful are longitudinal studies that remove the biases associated with asking individuals to report on behavior over extended periods of time. Future research could make slight modifications to the scale measures presented here in order to measure levels of group processes over time. Third, innovation is also frequently conceptualized as a process that includes the generation, selection, and implementation of novel ideas (Baregheh, Rowley, & Sambrook, 2009; West, 2002). In this study, rankings of final innovative output were used as an indication of the extent to which individuals were successful in engaging in this process—an approach commonly suggested for measuring innovation (Anderson, De Dreu, & Nijstad, 2004; West & Farr, 1991). Nonetheless, future research could look at the extent to which the COI elements (composition, climate, and process) are related to each step of the innovation process, thus providing a broader picture of the impact of these elements and process of innovation.

Conclusion

The primary contribution of this study is a better understanding of the composition, climate, and process variables that contribute to team-level innovation. Using data from business school teams enrolled in a class on innovation and entrepreneurship, I explored the extent to which the composition, climate, and process variables proposed by the COI framework discriminated between high- and low-ranking innovative teams and then investigated their empirical distinctness using bivariate correlations. In particular, I focused on the process of dynamic expertise and its important predictors, including flow and support for innovation were explored. Finally, the relationship between the proposed composition, climate, and process variables and the odds of being in an innovative team was investigated.

Of particular concern for the COI moving forward is the significant empirical overlap in the measurement of the climate and process elements of the COI. More specifically, all of the climate elements proposed by the COI are moderately correlated when measured using West & Anderson’s (1998) team climate inventory. The processes of reflection, group flow, and dynamic expertise are also highly correlated. While the correlation between group flow and dynamic expertise is less concerning, the correlation between reflection and dynamic expertise may signal that in some way both measure the extent to which individuals are aware of and understand the problems facing their group. Moving forward, the COI should evaluate its use of all four facets of climate (vision, task orientation, participatory safety, and support for innovation) and more clearly define the specific elements of a supportive team climate that may be related to team innovativeness. Furthermore, future research on COIs should further explore the relationship between group reflection and dynamic expertise to explore whether these two processes are empirically and conceptually distinct.

Despite some measurement issues, support was provided for the inclusion of group flow and dynamic expertise as process variables in the COI framework moving forward. I found no support for the inclusion of group conflict. Furthermore, composition, as measured by functional and demographic diversity, had little influence on team-level innovation. Future research on the COI framework should work on refining the framework so as to more specifically outline which facets of diversity are most influential to communities of innovation.

This research increases understanding of the concept of dynamic expertise in particular, and provides strong evidence that the dynamic development of expertise is important to communities of innovation. In this study, expertise was conceptualized as a dynamic process rather than a static outcome or characteristic, and a nine-item dynamic expertise scale was developed and validated. Results suggest that a supportive climate and individual motivation are important preconditions to the dynamic development of expertise and that groups with individuals who are willing and able to develop new expertise are more innovative than those with members who do not push the edge of their competencies. This research suggests that expertise has an important role in creative innovations. I conclude that the critical factor is not *how much* expertise an individual has, but *how willing and how able* the individual is to push his or her competencies and live on the edge.

Finally, this research suggests the benefits of alternative statistical methods in studying the way process variables relate to team innovation. Most studies focusing on the antecedents to team-level innovation aggregate individual responses at the team-level (De Dreu, 2006; Drach-Zahavy & Somech, 2001; Hülsheger et al., 2009; Tjosvold et al. 2004). Such approaches utilize an ordinary least squares regression (De Dreu, 2006; West & Anderson, 1996) to assess the relationship between *team means* on process variables and *team* innovativeness. While some statistical techniques exist to help researchers determine the degree of homogeneity in team member's responses before aggregating the data (James, DeMaree, & Wolf, 1984), aggregation as a whole is not very sensitive to individual variation in team process reports. In other words, it is fairly optimistic to assume that all group members agree and, therefore, offer similar responses as to what is really occurring in their team. In contrast, this study retains within-team variation in individual responses on group process measures by using a multinomial logistic model to explore the relationship between *individual* report of group processes and the odds of being in a high-ranking *innovative team*. In other words, the important relationship is now between individual perceptions and team innovativeness; or the focus is on the likelihood that an individual will be in an innovative team based on their perceptions of the extent to which certain group processes actually occur in their team. Group process researchers should be more concerned with retaining within-team variation in self-report assessments of group processes. This includes using more advanced regression techniques like ordered logistic regression or multinomial logistic regression models. Certainly group process and innovation research could benefit by adopting such an approach.

References

Amabile, T. M. (1983). *The social psychology of creativity*. New York, NY: Springer-Verlag.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the work environment for creativity. *The Academy of Management Journal*, *39*(5), 1154-1184.

Amabile, T. M. (1998). How to kill creativity. *Harvard Business Review*, *76*(5), 76-87.

Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: Development and validation of the team climate. *Journal of Organizational Behavior*, *19*(3), 235-258.

Anderson, N., De Dreu, C. K. W., & Nijstad, B. (2004). The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of Organizational Behavior*, *25*(2), 147-173.

Baer, J., Kaufman, J. C., & Gentile, C. A. (2004). Extension of the consensual assessment technique to nonparallel creative products. *Creativity Research Journal, 16*(1), 113-117.

Bantel, K. A., & Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal, 10*(S1), 107-124.

Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision, 47*(8), 1323-1339.

Bell, S. T., Villado, A. J., Lukasik, M. A., Belau, L., & Briggs, A. L. (2010). Getting specific about demographic diversity variable and team performance relationships: A meta-analysis. *Journal of Management, 37*(3), 709-743.

Bercovitz, J., & Feldman, M. (2011). The mechanisms of collaboration in inventive teams: Composition, social networks, and geography. *Research Policy, 40*(1), 81-93.

Bereiter, C., & Scardamalia, M. (1993). *Surpassing ourselves*. Peru, IL: Open Court Publishing Company.

Birkinshaw, J., Bouquet, C., & Barsoux, J. L. (2011). The 5 myths of innovation. *MIT Sloan Management Review, 52*(2), 43-50.

Burningham, C. & West, M. A. (1995). Individual, climate, and group interaction processes as predictors of work team innovation. *Small Group Research, 26*(1),106-117.

Camerer, C., & Johnson, E. (1991). The process-performance paradox in expert judgment: How can experts know so much and predict so badly? In K. A. Ericsson & J. Smith (Eds.), *Towards a general theory of expertise: Prospects and limits* (pp. 195-217). New York, NY: Cambridge University Press.

Carter, S. M., & West, M. A. (1998). Reflexivity, effectiveness, and mental health in BBC-TV production teams. *Small Group Research*, *29*(5), 583-601.

Ceja, L., & Navarro, J. (2011). Dynamic patterns of flow in the workplace: Characterizing within-individual variability using a complexity science approach. *Journal of Organizational Behavior, 32*(4), 627-651.

Chase, W., & Simon, H. (1973). Skill in chess. *American Scientist, 61*(4), 394-403.

Chen, C. J., Huang, J. W., & Hsiao, Y. C. (2010). Knowledge management and innovativeness: The role of organizational climate and structure. *International Journal of Manpower, 31*(8), 848-870.

Chi, M. T. H. (2006). Two approaches to the study of experts' characteristics. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and performance* (pp. 21-30). New York, NY: Cambridge University Press.

Chi, N. W., Huang, Y. M., & Lin, S. C. (2009). A double-edged sword? Exploring the curvilinear relationship between organizational tenure diversity and team innovation: The moderating role of team-oriented HR practices. *Group & Organization Management, 34*(6), 698-726.

Coakes, E., & Smith, P. (2007). Developing communities of innovation by identifying innovation champions. *The Learning Organization, 14*(1), 74–85.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management, 23*(3), 239–290.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* New York, NY: HarperCollins.

Dane, E. (2010). Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective. *Academy of Management Review, 35*(4), 579-603.

De Dreu, C. K. W. (2006). When too little or too much hurts: Evidence for a curvilinear relationship between task conflict and innovation in teams. *Journal of Management, 32*(1), 83-107.

De Dreu, C. K. W. (2008). The virtue and vice of workplace conflict: Food for (pessimistic) thought. *Journal of Organizational Behavior, 2*(1), 5-18

De Dreu, C. K. W., & Weingart, L. R. (2003). Task versus relationship conflict, team performance, and team member satisfaction: A meta-analysis. *Journal of Applied Psychology, 88*(4), 741-749.

Drach-Zahavy, A., & Somech, A. (2001). Understanding team innovation: The role of team processes and structures. *Group Dynamics: Theory, Research*, *and Practice*, *5*(2), 111-123.

Duvivier, R. J., van Dalen, J., Muijtjens, A. M., Moulaert, V. R., van der Vleuten, C. P, & Scherpbier, A. J. (2011). The role of deliberate practice in the acquisition of clinical skills. *BMC Medical Education, 11*(1), 101-107.

Ericsson, K. A, & Lehmann, A. C. (1996). Expert and exceptional performance: Evidence of maximal adaptation to task constraints. *Annual Review of Psychology, 47*(1), 273-305.

Ericsson, K. A. (1998). The scientific study of expert levels of performance: General implications for optimal learning and creativity. *High Ability Studies, 9*(1), 75-100.

Ericsson, K. A. (1999). Creative expertise as superior reproducible performance: Innovative and flexible aspects of expert performance. *Psychological Inquiry, 10*(4), 329-334.

Ericsson, K. A. (2004). Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. *Academic Medicine, 79*(10), S70-S81.

Ericsson, K. A. (2005). Recent advances in expertise research: A commentary on the contributions to the special issue. *Applied Cognitive Psychology, 19*(2), 233-241.

Ericsson, K. A. (2008). Deliberate practice and acquisition of expert performance: A general overview. *Academic Emergency Medicine, 15*(11), 988-94.

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*(3), 363-406.

Ford, P. R., Ward, P., Hodges, N. J., & Williams, A. M. (2009). The role of deliberate practice and play in career progression in sport: The early engagement hypothesis. *High Ability Studies, 20*(1), 65-75.

Gebert, D., Boerner, S., & Kearney, E. (2006). Cross-functionality and innovation in new product development teams: A dilemmatic structure and its consequences for the management of diversity. *European Journal of Work and Organizational Psychology, 15*(4), 431-458.

George, J. M. (2008). Creativity in organizations. *The Academy of Management Annals, 1*(1), 439-477.

Glaveanu, V. P. (2012). Habitual creativity : Revising habit, reconceptualizing creativity. *Review of General Psychology, 16*(1), 78-92.

Griffin, M. A., & Mathieu, J. E. (1997). Modeling organizational processes across hierarchical levels: climate, leadership, and group process in work groups. *Journal of Organizational Behavior, 18*(6), 731–744.

Hackman, J. R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of organizational behavior* (pp. 315-342). Englewood Cliffs, NJ: Prentice-Hall, Inc.

Hakkarainen, K., Palonen, T., Paavola, S., & Lehtinen, E. (2004). *Communities of networked expertise: Professional and educational perspectives*. Oxford, UK: Elsevier Ltd.

Hao, N. (2010). The effects of domain knowledge and instructional manipulation on creative idea generation. *The Journal of Creative Behavior, 44*(4), 237-257.

Hoffmann, J. P. (2004). *Generalized linear models: An applied approach*. Boston, MA: Pearson Education, Inc.

Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *The Journal of Applied Psychology, 94*(5), 1128-45.

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: from input-process-output models to IMOI models. *Annual Review of Psychology, 56*(1), 517-43.

Jackson, S., & Marsh, H. (1996). Development and validation of a scale to measure optimal experience: The flow state scale. *Journal of Sport & Exercise Psychology, 18*(1), 17-35.

James, L. R., DeMaree, R. G., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology*, *69*(1), 85-98.

Janssen, O. (2001). Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction. *Academy of Management Journal, 44*(5), 1039-1050.

Jehn, K. A. (1995). A multi method explanation of the benefits and detriments of intragroup conflict. *Administrative Science Quarterly, 40*(2), 256-282.

Justesen, S. (2004). Innoversity in communities of practice. In P. Hildreth & C. Kimble (Eds.), *Knowledge networks: Innovation through communities of practice* (pp. 79-95). Hershey, PA: Idea Group Inc.

Kapur, M. (2008). Productive failure. *Cognition and Instruction, 26*(3), 379-424.

Kellogg, R. T., & Whiteford, A. P. (2009). Training advanced writing skills: The case for deliberate practice. *Educational Psychologist, 44*(4), 250-266.

Kivimaki, M., & Elovainio, M. (1999). A short version of the team climate inventory: Development and psychometric properties. *Journal of Occupational and Organizational Psychology, 72*(2), 241–246.

Lewandowsky, S., Little, D., & Kalish, M. L. (2006). Knowledge and expertise. In F. Durso (Ed.), *Handbook of applied cognition* (2nd ed., pp. 83-111). New York, NY: John Wiley & Sons Ltd.

Loo, R., & Loewen, P. (2002). A confirmatory factor-analytic and psychometric examination of the Team Climate Inventory: Full and short versions. *Small Group Research, 33*(2), 254-265.

Mannix, E. (2005). What differences make a difference? The promise and reality of diverse teams in organizations. *Psychological Science, 6*(2), 31-55.

Marks, M., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *The Academy of Management Review, 26*(3), 356-376.

Mathieu, J., 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.

Mathisen, G. A., Martinsen, O, Einarsen, S. (2008). The relationship between creative personality composition, innovative team climate, and team innovativeness: An input-process-output perspective. *Journal of Creative Behavior, 42*(1)13-31.

Milliken, F. J., Bartel, C. A., & Kurtzberg, T. R. (2003). Diversity and creativity in workgroups: A dynamic perspective on the affective and cognitive processes that link diversity and performance. In P. B. Paulus & B. A. Nijstad (Eds.), *Group diversity: Innovation through collaboration* (pp. 32-62). New York: Oxford University Press.

Mitchell Jr., R. C. (1988). Sociological implications of the flow experience. In M. Csikszentmihalyi & I. S. Csikszentmihalyi (Eds.), *Optimal experiences: Psychological* *studies of flow in consciousness* (pp. 36-59). New York, NY: Cambridge University Press.

Muller, A., Herbig, B., & Petrovic, K. (2008). The explication of implicit team knowledge and its supporting effect on team processes and technical innovations: An action regulation perspective on team reflexivity. *Small Group Research, 40*(1), 28-51.

Nemeth, C. J., & Nemeth-Brown, B. (2003). Better than individuals? The potential benefits of dissent and diversity on group creativity. In P. B. Paulus & B. A. Nijstad (Eds.), *Group diversity: Innovation through collaboration* (pp. 63-84). New York: Oxford University Press.

Nijstad, B. A., De Dreu, C. K. W., Rietzschel, E. F., & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology, 21*(1), 34–77.

Nsenduluka, E., & Shee, H. K. (2007). Organisational and group antecedents of work group service innovativeness. *Journal of Management, 15*(4), 438-451.

Perretti, F., & Negro, G. (2007). Mixing genres and matching people: a study in innovation and team composition in Hollywood. *Journal of Organizational Behavior*, 28(5), 563–586.

Pirola-Merlo, A. (2010). Agile innovation: The role of team climate in rapid research and development. *Journal of Occupational and Organizational Psychology, 83*(4), 1075-1084.

Pirola-Merlo, A., Hartel, E., Mann, L., & Hirst, G. (2002). How leaders influence the impact of affective events on team climate and performance in R&D teams. *The Leadership Quarterly, 12*(5), 561-581, Post, C., Lia, E. D., Ditomaso, N., Tirpak, T. M., & Borwankar, R. (2009). Capitalizing on thought diversity for innovation. *Research-Technology Management, 52*(6), 14-25.

Quinn, R. W. (2005). Flow in knowledge work: high performance experience in the design of national security technology. *Administrative Science Quarterly, 50*(4), 610-641.

Reichers, A. E., & Schneider, B. (1990). Climate and culture: An evolution of constructs. In B. Schneider (Ed.), *Organizational Climate and Culture* (pp. 5-39). San Francisco, CA: Jossey-Bass Inc.

Reilly, R. C. (2008). Is expertise a necessary precondition for creativity? *Thinking Skills and Creativity, 3*(1), 59–76.

Rietzschel, E. F. (2011). Collective regulatory focus predicts specific aspects of team innovation. *Group Processes & Intergroup Relations, 14*(3), 337-345.

Saleh, S. D., & Wang, C. K. (1993). The management of innovation: strategy, structure, and organizational climate. *IEEE Transactions on Engineering Management, 40*(1), 14-21.

Sawyer, K. (2008). *Group genius: The creative power of collaboration*. New York: Basic Books.

Shalley, C. E. (1995). Effects of coaction, expected evaluation, and goal setting on creativity and productivity. *Academy of Management Journal, 38*(2), 483–503.

Simonton, D. K. (2003). Expertise, competence, and creative ability: The perplexing complexities. In R. J. Sternberg & E. L. Grigorenko (Eds.), *The psychology of abilities, competencies, and expertise* (pp. 213-238), New York, NY: Cambridge University Press.

Somech, A. (2006). The effects of leadership style and team process on performance and innovation in functionally heterogeneous teams. *Journal of Management, 32*(1), 132-157.

Tjosvold, D., Tang, M. M., & West, M. (2004). Reflexivity for team innovation in China: The contribution of goal interdependence. *Group & Organization Management, 29*(5), 540-559.

Van de Ven, A. H. (2007). *Engaged scholarship: A guide for organizational and social research*. New York, NY: Oxford University Press.

van Knippenberg, D., & Schippers, M. C. (2007). Work group diversity. *Annual Review of Psychology, 58*(1), 515-41.

van Knippenberg, D., De Dreu, C. K. W., & Homan, A. C. (2004). Work group diversity and group performance: an integrative model and research agenda. *The Journal of applied psychology, 89*(6), 1008-22.

Weisberg, R. (1998). Creativity and knowledge: A challenge to theories. In R.J. Sternberg (Ed.), *Handbook of creativity* (pp. 226-250), New York, NY: Cambridge University Press.

Weisberg, R. W. (2006). Modes of expertise in creative thinking: Evidence from case studies. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. J. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 761-787). New York, NY: Cambridge University Press.

Wenger, E. C., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78*(1), 139–146.

West, M. A. (2002). Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups. *Applied Psychology: An International Review, 51*(3), 355–387.

West, M. A., & Anderson, N. R. (1996). Innovation in top management teams. *Journal of Applied Psychology, 81*(6), 680-693.

West, M. A., & Farr, J. L. (1990). *Innovation and creativity at work: Psychological and organizational strategies*. New York, NY: John Wiley & Sons.

West, M. A., & Wallace, M. A. (1991). Innovation in health care teams. *European Journal of Social Psychology, 21*(4), 303-315.

West, R. E. (2009). What is shared? A framework for understanding shared innovation within communities. *Educational Technology Research and Development, 57*(3), 315-332.

West, R. E., & Hannafin, M. J. (2011). Learning to design collaboratively: Participation of student designers in a community of innovation. *Instructional Science, 39*(6), 821-841.

Wiley, J. (1998). Expertise as mental set: The effects of domain knowledge in creative problem solving. *Memory & cognition, 26*(4), 716-730.

Yap, C. M., Chai, K. H., & Lemaire, P. (2005). An Empirical Study on Functional Diversity and Innovation in SMEs. *Creativity and Innovation Management, 14*(2), 176-190.

Tables

Table 1. Descriptive Statistics

	Mean/%	Std Dev.	Min-Max
Composition			
Demographic Diversity	48	-	-
Functional Diversity (log)	2.80	.581	1.79-4.22
Climate			
Participatory safety	15.91	2.06	10-20
Vision	14.77	2.24	11-19
Task orientation	11.32	1.54	7-14
Support for innovation	12.02	1.78	8-15
Process			
Group flow	20.63	3.59	9-30
Dynamic expertise	30.88	4.09	17-40
Reflection (factor 1 score)	8.06e-10	.84	-1.71- 2.35
Conflict	10.45	3.71	5-21
Controls	12.02	1.78	8-15
Group size	4.43	.78	2-5
Graduate student	30.88	4.09	17-40

N=56

Table 2. Factor Analysis Item Loadings, TCI Participatory Safety Scale (oblique rotation)

	Factor 1
1. "We are in it together" attitude	.593
2. Kept each other informed	.521
3. Felt understood and accepted by each other	.622
4. Real attempts to share information	.438

N=121, Alpha reliability= .656

Table 3. Factor Analysis Item Loadings, TCI Task Orientation Scale (oblique rotation)

	Factor 1
1. Prepared to question what team was doing	.664
2. Critically appraised potential weaknesses	.574
3. Built on each other's ideas	.583

N=120, Alpha reliability= .681

Table 4. Factor Analysis Item Loadings, TCI Vision Scale (oblique rotation)

	Factor 1
1. Agreement with team's objectives	.667
2. Understand team's objectives	.667
3. Found objectives to be worthwhile	.659
4. Found objectives to be achievable	.565

N= 120, Alpha reliability=.761

Table 5. Factor Analysis Item Loadings, TCI Support for Innovation Scale (oblique rotation)

	Factor 1
1. Looked for new ways of looking at problems	.706
2. Took time to develop new ideas	.689
3. Cooperated in order to help develop new ideas	.648

N=121, Alpha reliability= .760

Table 6. Factor Analysis Item Loadings, Conflict Scale (oblique rotation)

	Factor 1
1. Friction among members	.694
2. Personality conflict	.738
3. Emotional conflict	.802
4. Disagreement about opinions on work being done	.773
5. Conflict about ideas	.691

N= 120, Alpha reliability= .870

Table 7. Factor Analysis Item Loadings, Reflection Scale (oblique rotation)

	Factor 1	Factor 2
1. Regularly discussed whether working effectively	.682	
2. Methods used by team were often discussed	.602	
3. How well communicated was often discussed	.783	
4. Identified strengths and areas that needed improvement	.518	
5. Often reviewed its approach to getting things done	.481	
6. Team often reviewed objectives		.536
7. Modified objectives with changing circumstances		.431
8. Committed to ongoing improvement		.658
9. Open to improved ways of working		.653

N=120, Alpha reliability=.834

Table 8. Factor Analysis Item Loadings, Group Flow Scale (oblique rotation)

	Factor 1
1. Could sense how to perform activity well	.769
2. Could tell how to respond when things came up	.364
3. Could sense why the decisions I made were correct	.548
4. I knew what to do as each circumstance occurred	.558
5. Felt in total control of what I was doing	.644
6. Found experience to be totally rewarding	.618

N= 120, Alpha reliability= .748

Table 9. Principal Component Factor Analysis Item Loadings, Dynamic Expertise Scale (oblique rotation)

	Factor 1	Factor 2	Factor 3
1. Understood what group needed to succeed	**.669**	-.131	.059
2. Aware of what group needed to do to succeed	**.773**	-.106	.190
3. Felt motivated to help group succeed	**.871**	.070	.028
4. Felt capable of learning what was needed	**.761**	.158	-.198
5. Identified challenging new problems	.027	-.053	**.849**
6. Took on more challenging problems	.114	.210	**.617**
7. Gained new expertise related to major field	.153	**.755**	.026
8. Gained new expertise unrelated to major field	.009	**.853**	-.081
9. Was on the edge of competence	-.213	**.602**	.336

Table 10. Mean Difference in Group Processes/Diversity for High Innovative and Low Innovative Teams (T-Tests)

	Mean	*t* value
Dynamic Expertise		
High Groups	31.79	2.76**
Low Groups	28.59	
Group Flow		
High Groups	22.95	3.634***
Low Groups	19.47	
Reflection		
High Groups	31.63	3.520**
Low Groups	26.67	
Team Climate Inventory		
Vision		
High Groups	16.32	3.57**
Low Groups	14	
Support for Innovation		
High Groups	12.89	2.64*
Low Groups	11.35	
Task Orientation		
High Groups	11.79	.69
Low Groups	11.47	
Participatory Safety		
High Groups	17.00	3.44**
Low Groups	14.82	
Conflict		
High Groups	8.74	-3.31**
Low Groups	12.47	
Functional Diversity		
High Groups	1.23	.134
Low Groups	1.26	

*$p<.05$, **$p<.01$, ***$p<.001$

Table 11. Correlation matrix of all composition, climate, and process variables

	F. Diversity	P. Safety	T. Orient.	Vision	S. for innov.	Conflict	G. Flow	Reflect.	D. Expert.
Composition									
Functional Diversity	1.00								
Climate									
Participatory safety	-.03	1.00							
Task orientation	-.25	.37	1.00						
Vision	-.11	**.50**	**.41**	1.00					
Support for innovation	-.41	**.42**	**.62**	**.51**	1.00				
Process									
Conflict	.10	**-.48**	-.24	-.28	-.22	1.00			
Group flow	-.10	.37	.35	**.54**	.31	-.25	1.00		
Reflection	-.12	.39	.26	.24	.32	-.38	.33	1.00	
Dynamic Expertise	-.13	.32	.42	**.61**	.38	-.08	**.68**	**.45**	1.00

Note: Correlations above .4 in bold

Table 12. OLS regression model predicting individual levels of dynamic expertise (cluster robust standard errors in parentheses)

	Model 1	Model 2
Support for Innovation	.961** (.301)	.472 (.246)
Flow		.804*** (.116)
Constant	19.328*** (3.930)	8.619* (3.554)
R Squared	.138	.494
N	56	56

**p<.05, **p<.01, ***p<.001*

Table 13. Multinomial logistic regression model predicting odds of being in high or low innovative group (cluster robust standard errors in parentheses)

	Model 1		Model 2		Model 3		Model 4	
	High Group	Low Group	High Group	Low Group	High Group	Low Group	High Group	Low Group
Composition								
Demographic Diversity	.419	.290	.361	.277	.260	.230	.223	.233
	(.728)	(.444)	(.592)	(.404)	(.416)	(.323)	(.351)	(.315)
Functional Diversity	1.089	1.212	1.192	1.519	1.043	1.845	1.023	1.858
	(1.459)	(1.194)	(1.518)	(1.523)	(1.254)	(1.787)	(1.188)	(1.771)
Climate								
Support for Innovation			1.623*	.685	1.665	.624	1.615	.633
			(.344)	(.161)	(.594)	(.160)	(.607)	(.172)
Process								
Flow					1.683***	1.060	1.426***	1.048
					(.226)	(.087)	(.138)	(.111)
Dynamic Expertise							1.237**	1.013
							(.101)	(.099)
Controls								
Group Size	1.191	.700	1.598	.477	1.606	.437	2.145	.456
	(1.456)	(.514)	(1.664)	(.392)	(1.652)	(.421)	(2.149)	(.432)
N	56		56		56		56	

**p<.05, **p<.01, ***p<.001*

Notes: Relative Risk Ratio reported; Reference category is moderately innovative group

Appendix

Team Climate Inventory (TCI) (West & Anderson, 1998)-5-point Likert Scale

1. Vision
    a. To what extent did group members agree about the team's objectives?
    b. To what extent did group members clearly understand the team's objectives?
    c. To what extent did group members feel that the team's objectives were worthwhile?
    d. To what extent did team members agree that the objectives were achievable?
2. Participatory Safety
    a. We had a "we are in it together" attitude.
    b. People keep each other informed about work-related issues.
    c. People felt understood and accepted by each other
    d. There were real attempts to share information throughout the team.
3. Task Orientation
    a. Team members were prepared to question the basis of what the teams was doing.
    b. The team critically appraised potential weaknesses in what it is doing in order to achieve the best possible outcome.
    c. The team member's built on each other's idea in order to achieve the best possible outcome.
4. Support for Innovation
    a. People on this team always looked for fresh new ways of looking at problems.
    b. In this team, we took the time to develop new ideas.
    c. People in the team cooperated in order to help develop and apply new ideas.

Diversity Survey Items

1. What is your major (If Business Administration, please list your emphasis)?
2. Please list your official title at the job at which you have worked the longest (can include student employment positions, paid and unpaid internships)
3. How long have/did you work at this job?
4. What is your age?
5. What is your race?
6. What is your gender?

Intragroup Conflict Survey Items (Jehn, 1995)- 5-point Likert scale

1. How much friction is there among members in your work unit?
2. How much is personality conflict evident in your work unit?
3. How much tension is there among members in your work unit?
4. How much emotional conflict is there among members in your work unit?
5. How often do people in your work unit disagree about opinions regarding the work being done?
6. How frequently are there conflicts about ideas in your work unit?
7. How much conflict about the work you do is there in your work unit?
8. To what extent are their differences of opinion in your work unit?

Group Reflection Survey Items (Tjosvold, Tang, & West, 2004)- 5-point Likert scale

1. The team often reviewed its objectives.
2. We regularly discussed whether the team was working effectively together.
3. The methods used by the team to get the job done were often discussed.
4. In this team we modified our objectives in the light of changing circumstances.
5. How well we communicate information was often discussed.
6. This team often reviewed its approach to getting the job done.
7. Team members identified strengths in their work and areas that needed improvement.
8. Team members were committed to ongoing improvement.
9. Team members were open to improved ways of working.

Dynamic Expertise Survey Items 5-point Likert Scale

1. In this project, I struggled to understand what I could do to help the group succeed.
2. In this project, I identified challenging new problems that were not my responsibility, but were important for my group's success.
3. In this project, I was aware of what the group needed to do to be successful.
4. In this project, I felt motivated to do whatever it took for the group to be successful.
5. In this project, I tried to address challenging problems that pushed me out of my comfort zone.
6. In this project, I felt that I took on more and more challenging problems as the project progresses.
7. I gained new expertise unrelated to my major or program emphasis from my participation in this project.
8. I gained new expertise related to my major or program emphasis from my participation in this project.
9. In this project, I felt that I was on the edge of my competence, learning just enough to solve the challenge but was far from being comfortable.
10. In this project, I felt capable of learning whatever was needed to be able to solve the challenges that arose.

Group Flow Survey Items (Quinn, 2005)- 5-point Likert Scale

1. I could sense how to perform this activity well.
2. I could tell how to respond when things came up.
3. I could sense why the decisions I made were correct
4. I knew what to do as each circumstance occurred.
5. I felt in total control of what I was doing
6. I found this experience to be totally rewarding.
7. I was not concerned with how I was presenting myself.
8. As we worked on the project, It felt like time stopped.