The Effects of Expert-Mediated Exploration on Group Creativity and Group Decision Quality

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Abstract
With the emphasis on using groups to solve complicated societal and environmental challenges today, understanding the process of group creativity is extremely important. By identifying team composition variables that enhance the group creative processes and in turn predict greater group performance, organizations will be better able to design and facilitate problem solving groups. The current study examined how group creativity mediates the relationship between expert-mediated exploration, operationalized as variance in openness to new experience, extroversion, and self-esteem, and group performance, operationalized as group added value. Seventy-five 3-person groups from a university in the Pacific Northwest participated in the study (mean age 20.7 years). Participants completed two survival tasks, first individually and then as a group. The relationships between the identified variables were assessed using structural equation modeling. Results revealed an indirect relationship between expert-mediated exploration and group-added value, as mediated by group creativity. Possible explanations, implications, limitations, and suggestions for future research are discussed.

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The Effects of Expert-Mediated Exploration on Group Creativity and Group Decision Quality

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Abstract

With the emphasis on using groups to solve complicated societal and environmental challenges today, understanding the process of group creativity is extremely important. By identifying team composition variables that enhance the group creative processes and in turn predict greater group performance, organizations will be better able to design and facilitate problem solving groups. The current study examined how group creativity mediates the relationship between expert-mediated exploration, operationalized as variance in openness to new experience, extroversion, and self-esteem, and group performance, operationalized as group added value. Seventy-five 3-person groups from a university in the Pacific Northwest participated in the study (mean age 20.7 years). Participants completed two survival tasks, first individually and then as a group. The relationships between the identified variables were assessed using structural equation modeling. Results revealed an indirect relationship between expert-mediated exploration and group-added value, as mediated by group creativity. Possible explanations, implications, limitations, and suggestions for future research are discussed.
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I remember calling Dr. David Foster the first year of my doctoral program after hearing about a professor from Western Oregon University who was looking for graduate students interested in an ongoing project on group decision making. With little exposure to organizational psychology, the procedures that he verbosely explained seemed unfamiliar and out of line with my clinical interests. However, there was such an air of enthusiasm in his voice about the vast potential for exploration that I agreed to join his team. Over the six years that I have worked with Dr. Foster I have not only learned a wealth of knowledge about organizational psychology and teamwork, but I have also grown significantly as a researcher. From the grueling work of coding transcripts, to the exciting task of leading research assistants, Dr. Foster has consistently provided the perfect balance of challenge and support necessary for my development. I am so grateful for all of his guidance, positivity, and inspiration, which kept my research fun.

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Introduction and Statement of the Problem

The Importance of Group Creativity Today

The history of human beings has been characterized by technological and social progress. From the use of primitive hieroglyphics, to the launch of the first satellite, humans have used knowledge provided by predecessors to solve increasingly complicated problems. Paradoxically, the creative achievements of the past have played a large role in the instigation of a number of difficult and complicated dilemmas that we face today. For example, the medical and agricultural advances to date have led to a longer average lifespan and subsequent overpopulation (Buxton, 1957; Dawes, 1980). In order to support this growth in population, depletion of our natural resources has become an immediate concern (Dawes, 1980). Furthermore, with the explosion of commercial and corporate products, a hyper-competitive global market has developed in which the survival of organizations depends on the construction of intricate, cutting-edge products (Hage, 1999). In the face of such pressing challenges, creativity has become a vital element in today’s society. As Csikszentmihalyi suggests, “There is no question that the human species could not survive, either now or in the years to come, if creativity were to run dry” (1996, p.317).

The increasing complexity of the challenges facing humans today has also created the need to use groups of people to solve these issues. The use of groups is necessary because the information contained within the many domains of human knowledge, such as math, world relations, and chemistry, has increased exponentially over the last century. Consequently, it is virtually impossible for one single person to have all of the necessary
expertise to understand and solve these issues alone. Given these reasons, most organizations and scientific disciplines now rely on the work of teams (Paulus & Nijstad, 2003) and urgent societal decisions occur at an embassy level. The use of groups for making such difficult decisions is predicated on the assumptions that groups can produce higher quality decisions than individuals working alone (Brodbeck, Kerschreiter, Moijzisch, Frey, & Schulz-Hardt, 2002) and that groups can derive more creative solutions to problems than individuals (Paulus & Dzindolet, 1993). It is suggested that groups enhance creative performance because many perspectives and skills can be shared in the process of group brainstorming (Taggar, 2001). Furthermore, group processes may defer the process of selecting a single solution, thereby increasing the number of ideas considered (Osborn, 1963). Research also shows that groups are more likely than individuals to identify and correct mistakes, resulting in higher quality, creative decisions (Orlitzky & Hirokawa, 2001). Consequently, understanding and nurturing group creativity is more important now than ever before (Runco, 2004), as such understanding will allow organizations to actively design and manage teams more effectively.

**State of the literature on group creativity**

The concept of creativity has been examined and discussed in a massive volume of psychological literature. Such research has approached creativity from the varying perspectives of many subfields and interests, including cognition, motivation, personality, and organizational psychology. Dozens of definitions and models of creativity have been offered, including Guilford’s theory of divergent and convergent thinking (Guilford, 1950, 1957, 1967), Baer and Kaufman’s (2005) Amusement Park theoretical model of
creativity, and Kirton’s (1976) Adaptation-Innovation theory. Furthermore, many programs intended to enhance creativity have proliferated. For instance, Nunamaker et al. (1991) developed GroupSystems, the first commercial system designed to improve creativity of groups through electronic brainstorming (EBS), and a wide variety of more recent EBS tools are currently available.

There are three major gaps, however, in creativity research that have made it difficult to apply to the understanding of the group creative process. The first gap is the lack of universal consensus regarding the construct of creativity. Despite the impressive scope of literature, creativity continues to be regarded as one of the most enigmatic subjects in psychology (Kim, Cramond, & Bandalos, 2006). A major source of the perplexity surrounding the construct of creativity has been the inability of scientists and philosophers to agree upon an objective definition of creativity (Rookey, 1973; Feldhusen & Goh, 1995). The lack of a universally agreed upon definition of creativity makes it difficult to understand and conduct research on group creativity.

Secondly, research on creativity has focused almost exclusively on creativity of the individual. Little research has addressed the role of creativity in group problem solving and decision making. Consequently, most measures of creativity are catered to the assessment of individuals alone. In fact, Sternberg’s *Handbook on Creativity* (1999), a comprehensive review of the creativity findings until the 21st century, did not include group creativity in the subject index. It has been argued that only within the last 10 years has interest on group creativity begun to develop (Paulus & Nijstad, 2003). This increase
in interest has resulted in a few theories and models of group creativity, and organizational programs claimed to enhance employee creativity.

The third gap in the literature relates to the measurement of group creativity. Research addressing group creativity has relied almost entirely on the assessment of a creative product or solution. Measuring creativity via products may lack construct validity (Runco, 2004), suggesting that it may not capture the entire construct. For example, consider that one group spends very little time brainstorming but achieves a very innovative product due a single member’s contribution, while a second group working together effectively generates a number of highly innovative ideas but ultimately submits a poor product. Which group is more creative? More importantly, what can we understand about the creative process by watching these two very differently functioning groups? Although the method of measuring product creativity has demonstrated moderate to high reliability (Hennessey & Amabile, 1988), it may not be relevant for many “real-world” applications and tasks in which the creativity of a product is difficult to assess. In terms of decision-making tasks, measuring creativity through ratings of the product can be exceedingly difficult if the product is composed of choices among multiple options. For example, in survival tasks in which members must rank the importance of items, it is difficult to assess the group creativity based on submitted rank orders. In such tasks, while it is the creative process that allows groups to arrive at a solution based on how each item will be utilized, the creativity of the process is not effectively represented by the product.
Preliminary studies were performed in order fill the aforementioned gaps in the literature. Subsequently, a model and measure of the group creative process were established. Both the model and measure will be further described in the methods section. Prior studies demonstrated that the measure is a reliable indicator of the group creative process.

**Group Creativity as Mediating Variable**

According to the input mediator output input model (IMOI; Ilgen, Hollenbeck, Johnson, & Jundt, 2005) there are three interdependent levels of the group performance. This model places an emphasis on the intervening processes that are often overlooked as “black box phenomena” in research on direct effects of input variables on performance. According to the IMOI model, which is graphically presented below, input variables affect outcome variables indirectly through their effects on mediating processes.

![Figure 1. IMOI Model adapted from Ilgen, Hollenbeck, Johnson, & Jundt, 2005.](image)

While research on group creativity as an outcome (product) variable has been evolving, the role of group creativity as a mediator between input and outcome variables has been widely neglected. Group creativity is believed to enhance performance on decision-making tasks (Orlitzky & Hirokawa, 2001). Conceptualized in this way, group creativity no longer represents an outcome variable; rather, group performance is the
outcome variable. However, no empirical studies to date have examined the relationships between group creativity and group performance. When conceptualized as a process, group creativity is in a strong position to play a mediatory role between input variables and group performance.

Team composition is an input variable that is often regarded as a predictor of group performance (Bell, 2007; Peeters, Van Tuijl, Rutte & Reymen, 2006; Taggar, 2001). While it has recently become a popular focus of research on group performance (Bell, 2007), team composition is a relatively new concept in group research. For example, Bell’s (2007) meta-analysis of 89 studies examining composition variables as predictors of team performance did not include studies prior to 1980 due to sparse availability. Results of several studies, including Bell’s study, have indicated that several team composition variables are related to team performance, suggesting that the importance of team member characteristics cannot be overlooked. However, as studies on team characteristics proliferate, results are inconsistent and fragmented, and a number of important interactions among variables have yet to be examined.

Team composition typically refers to the collection of characteristics in a group (Levine & Moreland, 1990), including surface-level variables and deep-level characteristics. Surface-level composition variables portray demographic characteristics, such as age, race, and education, while deep-level composition variables portray underlying psychological characteristics, such as personality and attitude (Bell, 2007). While some deep-level characteristics, such as attitude, are more vulnerable to changes in context, enduring characteristics, such as personality, are of particular interest to
researchers because of their resiliency. The personality variables included in the Big-Five theory of personality (McCrae & Costa, 1989) are often targeted in research on team composition. Meanwhile, a number of other enduring, deep-level characteristics, such as self-esteem and general mental ability, have received very little attention in the literature.

Underlying the research interest in deep-level group composition is the concept that the characteristics that individuals bring into a group are likely to coalesce in a particular interactional pattern. Because interactional patterns affect the group process, it is theorized that particular group compositions will predict better performance. On a practical level, such teams that intrinsically work well together are likely to require less training and supervision, and are likely to produce better outcomes. Furthermore, performance will be less susceptible to changes in the work climate and task.

Team composition variables are typically measured in one of two ways: trait elevation or trait variance (Barrick, Stewart, Neubert, & Mount, 1998). Trait elevation, as represented by either averaged or summed individual scores for a trait, has been a more common method of measuring composition variables. It is likely that the preference for trait elevation is based on the belief that the total presence of a characteristic will most relate to performance. However, trait variability, or the variability in a particular characteristic among group members, is gaining prevalence in the literature, as it are likely to affect group performance in specific ways (Bell, 2007). For example, groups containing all highly extroverted individuals may experience a greater tendency toward competition and, ultimately, discord. Therefore, it may be more
effective to create groups in which there is greater variability among certain characteristics.

Though less common than trait elevation and variability, some studies operationalize team composition characteristics in terms of maximum and minimum (Bell, 2007), or highest or lowest scores among group members for a given characteristic. However, no research could be found in which team composition was operationalized as the distribution of a particular trait among members of varying expertise. The high presence of particular traits in members demonstrating the greatest level of task competence may predict improvements in group performance, while a high presence of these same traits in members demonstrating the poorest competence may predict detriments in performance. In such cases, performance may be improved when there is a greater the difference in the presentation of composition variables between the most and least competent member. Therefore, studies evaluating the effects of trait variability without considering the configuration of these variables among levels of expertise may contribute to the inconsistent findings that abound.

While the literature on the relationship between team composition and performance is growing, few studies have specifically examined how team composition variables affect the process of group creativity. In terms of the IMOI model, group creativity may mediate the relationship between team composition and performance, as a number of team composition variables often included in research appear to influence group creativity. For instance, openness to new experience, which has been found to relate to group performance, may affect creativity by enhancing fluency and flexibility.
Other variables, such as extroversion and self-esteem are likely to increase the likelihood that creative ideas will be shared, integrated, and evaluated. Furthermore, when the expert of the group provides the strongest influence of these characteristics, the outcome is likely to be maximized. For example, when the most expert member is high in extroversion, he or she may be most comfortable sharing ideas with other members. However, when the least expert member is most extroverted and therefore shares more ideas with the group, group decisions will be more influenced by the most ineffective member. Therefore, given the hypothesized relationship between group creativity and group performance, team compositions that facilitate expert-mediated exploration may also engender the greatest performance.

Team composition is an input variable that has been demonstrated to influence group performance. However, as described above, there is evidence to suggest that this relationship is mediated by the process of group creativity. Given the lack of research on the relationships between team composition and group creativity, and in turn between group creativity and group performance, the purpose of this study is to examine how the group creative process mediates the relationship between input, team composition variables that facilitate expert-mediated exploration, and output, group performance.
Literature Review

Team Composition Variables

**Personality factors.** Personality is a construct that has historically been defined in a diversity of ways. Despite the broad range of operations utilized to describe personality characteristics, there is generally strong consensus among the psychological populace that all personality characteristics can be categorized into one of five factors: openness to new experiences, conscientiousness, extroversion, agreeableness, and neuroticism (McCrae & Costa, 1987; McCrae & John, 1992). According to this five-factor model of personality, personality factors represent characteristic patterns of thinking, feeling, and acting. Therefore, personality is an enduring aspect of the self that influences both cognitive activities and interactions with others.

The composition of personality types in a group is often regarded as a strong predictor of team performance (Bell, 2007; Peeters et al, 2006). A number of studies have examined personality as a team composition variable. The results of these studies suggest various patterns of relationships between personality variables and team performance; however, results are inconsistent and fragmented (Bell, 2007). Personality variables are often measured in different ways, using elevation scores or variability scores, and many mediating process variables are assessed. Therefore, it has been difficult to render conclusions about optimal group composition. Here I review the literature regarding the effects of openness to new experience and extroversion on group creativity and performance.
**Openness to new experiences.** According to the 5-factor theory of personality, individuals high in openness to new experience are original, imaginative, broad-minded, and daring (McCrea & Costa, 1987; Feist, 1998). Among the many adjectives used to describe openness to new experience, some notable characteristics include creative, aesthetic, achievement-oriented, curious, and flexible (Feist, 1998). People with high openness scores are distinguished from people with low openness scores, who in contrast tend to display conventional, traditional thinking, preference for familiarity, and resistance to change.

Openness to new experience is rarely included in either research about team performance (Peeters, Van Tuijl, Rutte, & Reymen, 2006) or group creativity. Theoretically, there is strong support for a relationship between openness to new experience and individual creativity. Csikszentmihalyi (1996) writes that creative individuals tend to be more open and sensitive, which allows them more exposure to both the suffering and enjoyment of life that fuels creative endeavors. He further asserts that rigid individuals should be more likely to rely on strongly held patterns of thought and behavior, reducing the possibility of creative ideas. According to McCrae and Sutin (2009), individuals with high openness scores are eager to explore alternative solutions in the search for new ways of dealing with a given problem. LePine (2003) suggests that team members with stronger openness to new experience may be more adaptable to change (flexibility), build upon other members’ ideas (integration), and look for alternative ways to solve problems (fluency). Furthermore, members with high openness
to new experience may foster a creative atmosphere by enriching learning opportunities and satisfaction (Molleman, Nauta, & Jehn, 2004).

Individuals with greater openness to new experience may have higher epistemic motivation, or willingness to expend effort to achieve a thorough, rich, and accurate understanding of the world (Feist, 1998). In turn, individuals with strong motivation to learn are likely to be curious about the world, to ask questions, and in turn to engage in conversations. This craving for knowledge about the world connotes a greater propensity for exploration, discussion with others, and interest in solving problems.

Feist (1998) conducted a meta-analysis of personality comparing scientists from nonscientists, creative from less creative scientists, and artists from nonartists. A total of 83 studies were included in the research. Scientists were defined as individuals from junior high through adulthood who demonstrated special talent in the sciences, while artists were defined as students majoring in art or adults earning a living in an artistic domain, such as writing, dance, or music. Inventories used to investigate creativity in the studies included in the analysis included the California Psychological Inventory (CPI), the 16PF, and the EPQ. Results demonstrated that higher openness to new experience distinguished more creative scientists from less creative scientists and non-scientists. Furthermore, of the personality factors, openness to new experience had the highest effect size for artists versus non-artists. In summary the author asserted that regardless of the measure used to assess personality or creativity, creative individuals were more open to new experience and self-confident/self-accepting.
The above studies identify a relationship between openness to new experience and individual creativity, suggesting that openness to new experience will also affect group creativity. However, relatively few studies have examined the relationship between openness to new experience and group performance, and none were found regarding openness to new experience and group creativity. In a meta-analysis of team composition variables and team performance, Bell (2007) found that group openness to experience was related to higher team performance in field settings. In this study, the highest effects were for those in which openness was operationalized in terms of team elevation, specifically team mean.

Peeters et al. (2006) conducted a more narrowly focused meta-analysis exploring the specific relationships between personality composition variables and group performance utilizing a total of six to nine studies depending on the trait under investigation. Contrary to expectations, this study did not find a significant relationship between total openness to new experiences scores and team performance. Furthermore, variability in openness to experience was not related to performance. The main limitation of this meta-analysis, the author commented, was the small number of correlations utilized in the study.

Most studies evaluating openness to new experience and group performance tend to measure openness in new experience in terms of total or mean scores. For example, in Bell’s study, while 20 correlations included operationalized openness to new experience as mean scores, only 10 operationalized it as heterogeneity scores. However, some researchers suggest that when there is little variability in openness to new experience
there may be less group cohesion and conflict due to competition for ideas to be heard (Van Vianen & De Dreu, 2001). Although the few studies measuring the variance of openness to new experience in the above meta-analyses found negligible results, it can be hypothesized that how this characteristic is distributed among members plays an important role on its effects. For example, when the most expert member is substantially higher in openness to new experience than the least expert member, group performance may be optimized. However, distribution of characteristics among the most and least expert member has not been addressed in the literature.

In summary, research suggests that openness to new experience correlates to team performance. Furthermore, the literature suggests that openness to new experience enhances creativity. Therefore, group creativity may mediate a relationship between openness to new experience and group performance. However, as stated previously, there is a dearth of research examining this relationship.

**Extroversion.** Extroversion reflects the level to which individuals engage with the outside world (McCrea & Costa, 1987). Among other adjectives used to describe the construct of extroversion, some noteworthy ones include active, enthusiastic, gregarious, and expressive (Feist, 1998). Theoretically, these qualities infer a predisposition for expressive interaction with others and comfort sharing ideas.

Early studies of outstanding creative individuals have revealed a salient tendency toward introversion in highly creative persons; suggesting extroversion may be negatively correlated with creativity (MacKinnon, 1960; Guilford, 1967). However, more recently Schuldberg (2005) conducted a correlational study on the relationships
between the Eysenck personality questionnaire and measures of schizotypy, hypomania, and creativity with a sample of 625 undergraduates. This study was prompted by a body of literature supporting significant correlations between psychosis and creativity, and somewhat weaker correlations between extroversion and creativity (Kline & Cooper, 1986). Schuldberg’s results supported these findings, identifying a strong relationship between extroversion and creativity. Schuldberg posited that extroversion plays an integral role in creativity as the result of greater positive affect. While his study focuses exclusively on the relationship between psychological characteristics and individual creativity, it nonetheless provides support for a relationship between extroversion and creativity at the individual level.

In groups, researchers suspect that higher levels of extroversion will enrich performance by fostering discussion and enthusiasm (Costa & McCrea, 1992) and positive attitude toward teamwork (Barrick, Stewart, Neubert, & Mount, 1998). Porter et al. (2003) found that teams high in extroversion seek help from one another when needed. Bell (2007) found that in field settings, total team extroversion was positively related to team performance.

However, as in openness to new experience, extroversion in a high proportion of group members may result in greater competition to be heard, thereby reducing group effectiveness. For extroverted individuals, there tends to be a pull toward dominating group discussion. In the case that there are more extroverted individuals in a group, there may be a greater struggle to dominate, resulting in greater conflict. Some researchers warn that the extroverts’ focus on the pleasurable effects of group interaction may
distract the team from the ultimate task (Neuman, Wagner, & Christiansen, 1999). However, studies regarding extroversion variability have been very limited, and those that have been conducted have not uncovered significant results. Bell found that the relationship between variability in extroversion and team performance was negligible. Peeters, Van Tuijl, Rutte, & Reymen (2006) found that while the relationship between variability in extroversion and team performance was in the predicted direction, this relationship was not significant.

Again, the insignificant regarding findings extroversion variability and group performance may be due to the failure to specify how the variability is distributed. When the most expert member is significantly more extroverted than the least expert member, it can be hypothesized that performance will be optimized.

Extroversion may enhance group creativity, which in turn may predict greater performance. Furthermore, there is evidence to suggest that variability in extroversion may result in more complementary group dynamics. Therefore, there is currently a need to examine the mediating effects of group creativity in a potential relationship between variability in extroversion and team performance.

**Self-Esteem.** Though it is not included in the Big-Five theory of personality, self-esteem is a deep-level composition variable that is likely to play a role in group creativity. Whereas in individual work, thought sharing is of nominal import, in order for ideas to be contemplated and expounded upon in groups, members must have the confidence to relay their thoughts. Research indicates that noncommon ideas are less likely to be expressed in groups (Nemeth & Nemeth-Brown, 2003). Particularly in
regards to group tasks requiring creativity, individuals must have the self-esteem to share such ideas that are unique at the risk of sounding peculiar.

Self-esteem may also play a large role in the group’s propensity to evaluate ideas. When initial agreement is strong there can be a quick tendency toward group consensus and premature closure (Nemeth & Nemeth-Brown, 2003), which reduces evaluation and consequently, creativity. By critiquing ideas, solutions are allowed to evolve in positive directions. The importance of evaluation is contrary to typical brainstorming instructions, which ask members to refrain from evaluating in order to avoid slowing down idea generation and reducing willingness to expose selves and ideas to evaluation. However, evaluation appears to play a critical role in decision-making and problem solving tasks, as groups must evaluate the problem and define workable solutions (Brophy, 1998). Guilford (1950) hypothesized that evaluation is required for the selection of surviving ideas. Furthermore, research suggests that evaluation of the negative consequences of solutions is a strong predictor of group decision making quality (Orlitzky & Hirokawa, 2001).

Additionally, self-esteem may enhance the group’s tendency to dissent on commonly held ideas. As groups are likely to experience convergent thought, which reduces creativity (Hackman, 1990; Nemeth, 1997), when members are higher in self-esteem they may be more likely to dissent, thereby counteracting these effects. Because dissent liberates groups from conformity and stimulates more creative thoughts and solutions (Nemeth and Nemeth-Brown, 2003), it is likely to play a critical role in decision-making and problem-solving.
Surprisingly, the role of self-esteem is also often overlooked in research on group creativity. In Paulus and Nijstad’s volume on group creativity (2003), which attempted to bring together a collection of the latest work in the field, self-esteem was not specifically addressed. The closest variable to self-esteem discussed was willingness to contribute, which Milliken, Wiesenfeld, Martins, Salgado, and Dunn-Jensen (2003) described as the inclination to share ideas, opinions, and perspectives rather than to self-censor. However, as opposed to operationalizing this variable as an enduring trait, the authors instead considered willingness to contribute as highly sensitive to the group’s affective reactions, which can either support or undermine willingness to contribute. Despite their differences, both self-esteem and willingness to contribute can be viewed as precursors to comfort sharing creative ideas, which is likely to enhance the group’s performance.

Woodman and Schoenfeldt’s (1989) structural model of personality and cognitive factors related to creativity included self-esteem, in addition to locus of control, autonomy, cognitive complexity, perceptual openness, field independence, dogmatism, and intuition. Furthermore, the How Do You Think instrument (Davis & Subkoviak, 1975), intended to measure creativity, taps into what the author defines as self-confidence. However, very little literature on group performance has addressed self-esteem directly, and empirical research on the relationships between self-esteem, creativity, and group performance remains unavailable.

**The Expert Role.** Knowledge base and domain-specific skills are often regarded as major components of creative thinking processes (Feldhusen & Goh, 1995).
Therefore, the expert member of the group may play an important role in group performance. When working in groups, members contribute both unique and common, or shared, information to the group process. Theoretically, common information is much more likely to enter the pool of group ideas than uniquely held information simply because common information is much more likely to be shared by at least one of the members, whereas the sharing of uniquely held knowledge is dependent on a single member alone. The bias for common information to influence the group is called sampling bias. A study by Stasser, Taylor, and Hanna (1989) demonstrated the sampling error in group decision-making tasks very clearly. Groups of six were presented with 3 decision alternatives. Each member’s relevant knowledge base was first collected individually. Groups were then assigned to discuss relevant information for 15 minutes before arriving at a group decision. Results indicated that while 70% of commonly held information entered the group decision-making process, only 21% of uniquely held information was shared.

One method that researchers have proposed to overcome sampling bias is by assigning expert roles. According to this method, each member is assigned a specific area of expertise and advised to contribute only knowledge from within this domain. In this way, more uniquely held information is likely to be discussed. However, expert assignment’s effect on the sampling bias is limited. For example, Stasser, Vaughan, and Stewart (2000) demonstrated that the percentage of unique information shared only increased from 29% to 34% with role assignment. In this and other similar studies, expert assignment was experimentally manipulated in such a way that information was
provided pertaining to each area of expertise. Stasser and Birchmeir (2003) suggest, however, that strict adherence to expert roles during discussion may not occur easily or naturally.

While research emphasizes the importance of unique information within areas of expertise, little research has examined the likelihood that previously learned unique information will be shared, or that sampling bias will be mitigated, based on group composition. It can be hypothesized that in any task one member will hold the greatest wealth of related unique knowledge. This member can be conceptualized as the group expert. However, sampling error greatly undermines the likelihood that it will be shared with the group. Therefore, it is important if any expert personality characteristics and/or group compositions reduce the sampling bias and improve the probability that the expert’s unique information will join the pool of information.

As discussed above, expert members who are more open to new experience are more likely to be creative. Furthermore, expert members who are more extroverted and higher in self-esteem are more likely to feel comfortable sharing ideas. Therefore, the purpose of this study is to empirically examine the indirect relationship between expert-mediated exploration and group performance, as mediated by group creativity.
Purpose of the Study and Hypotheses

The overarching purpose of this study is to explore the relationships between team composition, the group creative process, and group performance. The question that this study sought to answer was: does the group creative process mediate the relationship between expert-mediated exploration, as operationalized by variance in openness to new experiences, extroversion, and self-esteem, and group performance? The literature suggests that openness to new-experiences, extroversion, and self-esteem positively influence group performance. However, the relationship between these variables and group creativity is still unclear. Based on the literature, these variables are likely to positively influence the group creative process by maximizing fluency, flexibility, integration, and evaluation. Given the proposed effect, determining whether or not the group creative process mediates the relationship between team composition and group performance could enhance our understanding of how creative groups perform.

This study offers clinical significance in seeking to identify team composition variables that maximize group creativity and, in turn, group performance. Knowledge about the composition variables that predict group performance via their effects on group creativity can help researchers and managers to design, train, and facilitate teams engaging in decision-making tasks.

In addition to providing information about the relationships between group team composition, group creativity, and performance, this study will provide a number of unique contributions to research on group creativity. The first of these contributions is initiation of a measure of the group creative process. As described above, past research
on group creativity has been largely stifled by reliance on evaluation measures as based on a product. Such measures have made it particularly difficult to measure the creativity of groups engaging in decision-making tasks, where the creativity of the product is not overtly reflected. Furthermore, these measures have made it difficult to discriminate between groups that produce creative products and highly creative groups that produced less creative products.

A second contribution of this study is its theoretical underpinnings in a novel model of the group creative process. Prior research on group creativity has indeed been hindered by the lack of an organizational model of the group creative process. Therefore, the introduction of this model may allow further hypotheses about group creativity to be drawn, and may help explain some of the previously established findings.

A final contribution of this study is the use of a novel latent team composition variable, namely, expert-mediated exploration. This variable is composed of team characteristics that are proposed to maximize the likelihood that the group expert will most effectively lead creative endeavors of the group. Further research on expert-mediated exploration may help to clarify the expert’s role in group performance.

This study conceptualizes the input to group performance as expert-mediated exploration, which is composed of variance scores in openness to new experiences, extroversion, and self-esteem. The output of group performance is not conceptualized as the absolute accuracy of the group decision making but as group added value. Group added value is the effect of the group’s process on decision quality over and above the contributions of individual member expertise. It can be either positive or negative,
indicating whether the group performed at the level above or below the levels in which individual members performed when completing the tasks alone.

There are several goals for the current study. This study will seek to determine whether the group creative process mediates the relationship between expert-mediated exploration and group added value.

Hypothesis 1: Expert-mediated exploration will directly affect group creativity.

Hypothesis 2: Group creativity will directly affect group added value.

Hypothesis 3: The direct effects of expert-mediated exploration on group added value will not be significant.
Method

Participants

Participants were undergraduate psychology students. As incentive for their involvement, participants were eligible to receive extra credit in the psychology courses and a monetary award ($20 for the individual and $20 for each member of the group who were the most accurate in the task). Data were collected from a total of 276 participants in 92, three-person groups. Of these groups, only 80 groups had usable video/audio for analysis. Seventy five of the 80 usable groups were coded and utilized in the current study. 158 participants were females and 67 were males. The mean age was 20.7 years.

Design

The study employed a 2x2 between subjects experimental design involving two experimental manipulations: Forming and Feedback. The effects of feedback and forming were not assessed in the current study. For the Forming experimental manipulation, participants were randomly assigned to one of two conditions: Forming or No Forming. Participants in the Forming condition engaged in a team building exercise prior to the first decision making task, during which members answered prepared questions randomly drawn from different stacks of cards. Examples of questions include: “What is your major and why?” and “If you could go anywhere in the world where would you go and why?” Participants in the control, No Forming, condition read a brief paper on the stages of group development. Each activity lasted approximately five minutes.

For the Feedback manipulation, participants were randomly assigned to one of two conditions: Feedback or No Feedback. In the Feedback condition, groups were given
feedback about the performance of individual members on the first task after the completion of the first group task and before initiation of the second task. The feedback was verbally provided in the following format “According to the experts, person A, you are the most in agreement with the experts. Person B, you are second most in agreement, and person C you are the least in agreement with the experts.” After receiving this feedback, participants began work on the second task. Those in the No Feedback condition began the second task immediately following completion of the first task. For the current study, no significant effects were found for the Feedback manipulation, thus the two conditions were collapsed for subsequent analyses.

Task

Groups worked first individually and then collaboratively on one of different decision making tasks: a desert survival task and a moon survival task. In both scenarios, the groups were presented with a scenario in which they were stranded and left with a number of items that may aid in their survival. The groups’ tasks were to rank order these items in terms of their importance to the groups’ survival with lower numbers indicating greater importance (e.g., an item ranked number one would be considered to be most important to survival). The desert survival task required the groups to rank order ten items as compared to the moon survival task that required the groups to rank order fifteen items. Participants completed each exercise both individually and as a group. The order in which the exercises were completed was counterbalanced across experimental conditions.
Procedure

Informed consent was obtained for all participants. Participants first completed questionnaires assessing personality factors and self-esteem. Following completion of initial measures, depending on the experimental condition participants either engaged in the forming task or read a brief paper on the stages of group development. Then groups completed the first decision-making task; first individually and then as a group. When completing the task individually, participants were limited to five minutes. There was no time limit for completing the task as a group. After the groups completed the first task, participants either received feedback about their individual performances prior to beginning the second task or immediately began the second task. Each group was videotaped while performing both decision making tasks. After both tasks were completed, the groups were provided with the expert rankings, debriefed, given their extra credit, and thanked for their participation. As incentive for their involvement, participants received extra credit in their psychology courses. In addition, the best performing individual was offered a $20 award and the best performing group received a $60 award divided amongst the group members equally.

Coding. The videotaped interactions were transcribed by a transcription service and reviewed by several clinical psychology graduate students to correct transcription errors. These graduate students watched the videotapes and corrected mistranscribed sections, filled in sections the service deemed inaudible, corrected any speaker mislabels (e.g. if a statement was credited to person A but was originally spoken by speaker C), and divided the transcript up into thought units, which were defined as any unit of thought
that conveyed a complete thought. Subsequently, four undergraduate psychology students examined the cleaned transcripts and assigned one of four different behavioral codes to thought units that met the specified criteria for creative behavior. Each transcript was coded independently by two different coders. Coders then met and resolved any discrepancies in coding through a process of consensus.

**Measures**

**Group Creativity.** Creative behavior was operationalized as the extent to which groups engaged in divergent (idea generation) and convergent (evaluation) thinking. Divergent thinking was comprised of three different behaviors; fluency, flexibility, and integration. Fluency was defined as the ability to generate a succession of ideas, words, or associations meeting certain meaningful requirements (Guilford, 1957). Fluency was judged to have occurred when group members suggested conventional uses for the various items they were rank ordering (e.g., “We could [read] the book of plants to find edible plants.”). Flexibility refers to the ability to transform ideas (Guilford, 1967). Flexibility is the capacity to replace one conception of an object with a new, unconventional conception. Flexibility was judged to have occurred when group members suggested the novel use for an object (e.g., “We could light the book of plants to make a fire.”). Integration was defined as the synthesizing of various ideas to produce a novel concept or idea. Integration was judged to have occurred when group members suggested combining resources to achieve a goal (e.g., “We will need the compass to know what direction to go on the map.”). Convergent thinking included evaluation, which refers to the funneling down ideas. It was identified by statements examining the
negative or positive consequences of using an item (e.g. “We will not need the matches because they will not light up on the moon.”) Both positive (pros) and negative (cons) evaluations were recorded.

Frequency counts of each code were calculated for each group and then used as separate indicators of the latent variable of group creativity.

**Personality: Openness to new experiences and extroversion.** The personality factors of extroversion and openness were measured using a short version of the NEO five-factor personality scale. Each factor was assessed with seven items answered on a five-point Likert scale ranging from 1 = “Does not describe me at all” to 5 = “Describes me very well.” Items include: “I am a sociable and talkative person.” and “I like to try new activities, eat unusual foods, or go new places.” Both scales had acceptable internal consistency reliability: extroversion $\alpha = .77$, openness to experience $\alpha = .76$.

**Self-esteem.** Self-esteem was measured with the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Participants respond to 10 items on a four-point Likert response scale ranging from 1 = “Strongly Agree” to 4 = “Strongly Disagree”. Sample items include: “I feel that I have a number of good qualities.” and “I certainly feel useless at times.” $\alpha = .90$.

**Expert-mediated exploration.** Three group-level, observed variables were used as indicators of the latent variable expert-mediated exploration. These variables were indicators of how a given characteristic was distributed across group members relative to task expertise. The variables considered in this study were: self-esteem, extroversion, and openness to new experience. For each characteristic, an ordinal-level variable was created.
to reflect the distribution of the characteristic relative to group member expertise. Groups where the member with the most task expertise scored higher on the personality variable than the group member with the least task expertise were scored a “1.” Groups where the member with the most task expertise and the least task expertise were tied in their scores on the variable were scored a “0.” Finally, groups where the member with the least task expertise scored higher on the variable than the group member with the most task expertise were scored a “-1.” Consequently, groups highest in expert-mediated exploration would be groups were the most expert member had higher self-esteem, extroversion, and openness to new experience than the least expert member. The decision to utilize difference, rather than additive scores was predicated on the idea that the dynamics of the group creative process will be different when there is a difference between creative input from the most and least expert members.

**Group-added value.** Output was measured not by the absolute accuracy of the decision, but by the value added to the decision by group processes. Group-added value is the effect of the group’s process on decision quality over and above the contributions of individual member expertise. This outcome focuses on how group dynamics either enhance or undermine performance. The decision to use this level of analysis was predicated on the idea that group-added value reflects the influence of group processes whereas overall group accuracy does not indicate how the group process positively or negatively affected decision-making. In this way, group-added value allows for discriminations between groups that simply began with high individual scores and groups
that began with low individual scores but were able to perform to a high level as the result of group processes.

Group-added value was operationalized by means of a residual score. Therefore, group added value was equal to the residual of the group performance score, with the variance of individual member scores statistically removed via a multiple regression procedure for each group.

**Data Analysis**

The data were examined using Structural Equation Modeling (SEM). SEM is a multiple-equation regression model representing relationships among a number of variables (Fox, 2006) that is based on the general linear model (Ullman, 2006). This statistical procedure is effective in reducing data and testing models in behavioral and social sciences (Hox & bechger, 1998). The variables can be either measured (directly observed) or latent (not observed directly). A benefit of SEM is that it reduces the number of observed variables into a smaller number of latent variables by examining the covariation among the observed variables (Schreiber et al, 2006). Furthermore, the relationships between variables can include feedback loops, whereby one variable affects the other in a bidirectional fashion. Ullman (2006) contends that SEM is a particularly valuable technique for personality assessment. Due to the nature of this study, which contains two latent variables that are comprised of multiple observed variables, the researchers determined that this method of analysis was particularly appropriate for the current study.
A structural model was generated to compare the relationships among expert-mediated exploration and group-added value with and without the influences of group creativity. The observed group composition variables included openness to new experiences, extroversion, and self-esteem, which were theorized to mutually influence the latent group characteristic variable expert-mediated exploration. The observed group creativity variables were fluency, flexibility, integration, and evaluation. The dependent variable was group performance, which was the observed variable group-added value. This models allowed for us to thereby examine the direct and indirect effects of expert-mediated exploration and group creativity on group-added value.
Results

A SEM analysis was performed on the data using from the 276 participants, compiling 90 groups of 3 individuals each. A correlation table with unstandardized, standardized, and significance levels is presented in Table 1.

Table 1

*Standardized and Unstandardized coefficients*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized</th>
<th>Standardized</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness-EME</td>
<td>1.00</td>
<td>.726</td>
<td>0.05*</td>
</tr>
<tr>
<td>Extroversion-EME</td>
<td>.937</td>
<td>.704</td>
<td>0.05*</td>
</tr>
<tr>
<td>Self-esteem-EME</td>
<td>.737</td>
<td>.540</td>
<td>0.05*</td>
</tr>
<tr>
<td>Fluency-GC</td>
<td>1.00</td>
<td>.826</td>
<td>0.05*</td>
</tr>
<tr>
<td>Flexibility-GC</td>
<td>.960</td>
<td>.701</td>
<td>0.05*</td>
</tr>
<tr>
<td>Integration-GC</td>
<td>.307</td>
<td>.516</td>
<td>0.05*</td>
</tr>
<tr>
<td>Evaluation-GC</td>
<td>2.592</td>
<td>.576</td>
<td>0.05*</td>
</tr>
<tr>
<td>GAV-EME</td>
<td>.217</td>
<td>.174</td>
<td>.174</td>
</tr>
<tr>
<td>GAV-GC</td>
<td>.095</td>
<td>.272</td>
<td>.045*</td>
</tr>
<tr>
<td>GC-EME</td>
<td>.968</td>
<td>.304</td>
<td>.057</td>
</tr>
</tbody>
</table>

*Note:* EME = expert-mediated exploration; GC = group creativity; GAV = group-added value. Goodness of fit index = .926; comparative fit index = .929; chi square = 26.496; degrees of freedom = 18. e = error. * p≤ .05.
The structural equation model is presented in Figure 2 below. Latent variables are represented by circles, while observed variables are represented by rectangles.

*Figure 2.* Structural equation model (SEM) of expert-mediated exploration, group creativity, and group-added value. * = significant. e = error.
The three experimental hypotheses were assessed using the generated SEM. Results indicated that the direct relationship between expert-mediated exploration and group creativity was not significant, but was approaching significance (unstandardized $\beta=.968$, standardized $\beta=.304$, SE=.510, p=.057), providing some support for hypothesis 1. The direct effects of group creativity on group added value, however, were significant (unstandardized $\beta=.095$, standardized $\beta=.272$, p=.045), thereby providing support for hypothesis 2. Finally, the direct effects of expert-mediated exploration on group added value were assessed. As hypothesized, the direct relationship between expert-mediated exploration and group added value was not significant (unstandardized $\beta=.217$, standardized $\beta=.194$, p=.174)

**Establishing Mediation**

The purpose of the current analysis was to test whether group creativity mediates the relationship between expert-mediated exploration and group-added value. The most common steps of establishing mediation, as presented by Baron and Kenny (1986) and Judd and Kenny (1981), include demonstrating that 1) the criterion variable is correlated with the outcome, 2) the criterion variable is correlated with the mediator, 3) the mediator affects the outcome variable, and 4) the effect of the criterion variable on the outcome is not significant when controlled for the mediating variable. However, according to Kenny, when testing mediation in models containing latent variables, this method is not appropriate, as two estimated models, one with the mediator and one without, are not comparable because the factor loadings are different. Therefore, a single test of indirect effects is recommended (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002).
Bootstrapping is an increasingly popular test of indirect effects (Shrout & Bolger, 2002). Therefore, the data from the SEM were tested using a bootstrap analysis with 500 replications in order to test the indirect effects of expert-mediated exploration on group creativity. This test indicated that the indirect effect was significant at $p = .04$ (S.E. = .072).

The final analysis of the SEM was overall goodness of fit. To assess the overall goodness of fit, several values including the model's chi-square, goodness of fit index, comparative fit index, root mean squared error of approximation, and normed fit index. The results of goodness of fit analyses are presented in Table 2.

Table 2

*Fit Indices for Structural Equation Model*

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFI</td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td>GFI</td>
<td>.90</td>
<td></td>
</tr>
<tr>
<td>NFI</td>
<td>.82</td>
<td></td>
</tr>
<tr>
<td>CMIN</td>
<td>26.50</td>
<td>.09*</td>
</tr>
</tbody>
</table>

*Note:* CFI = comparative fit index; GFI = goodness of fit index; NFI = normed fit index; CMIN = chi-square. * Non-significance indicates fit.
Discussion and Conclusion

The purpose of this research project was to examine the relationships between team composition, represented by expert-mediated exploration, group creativity, and group added value; the variance in decision quality not explained by group member expertise. Results were assessed using the structural equation modeling technique in order to test the hypothesis that group creativity mediates the relationship between expert-mediated exploration and group-added value. The results revealed that expert-mediated exploration does indirectly predict higher group added value by its direct effects on group creativity, which were just below significance, and group creativity’s significant direct effects on group-added value. These findings support prior research and introduce new considerations for research. In addition, the study utilizes a novel, process-oriented measure of group creativity, which offers a new method of measurement for future research on group creativity. Implications, future directions for research on group creativity in research, and limitations of the current study will be discussed.

Expert-mediated exploration was conceptualized to reflect the degree to which the most expert member provided the greatest level of input for the creative process, which was also anticipated to result in less competition to be heard and conflict among members. Loadings generated from the structural equation model demonstrate that these team composition variables do indeed share a significant mutual relationship with one another and the latent variable, providing support for the construct of expert-mediated exploration.
Results of this study suggest that when a group contains an expert who is the most open to new experiences, extroverted, and high in self-esteem member of the group, the group will indeed perform better. These results seem highly intuitive, as group experts are likely to know the most accurate information relative to the task; therefore, when they are more engaged in the overall group process the group will benefit most from this information. However, what is particularly interesting about this study is that the direct effects of expert-mediated exploration on group-added value are not significant, but rather are mediated by the group creative process.

As predicted in the hypothesized structural model, the direct relationship between expert-mediated exploration and group creativity was approaching significance (.057) and in the predicted direction. This finding suggests that when the expert of the group facilitates the process of exploring ideas and tackling the task, group creativity is optimized. Therefore, the characteristics of expert-mediated exploration- openness to new experience, extroversion, and self-esteem- appear to not only benefit the group via the expert’s shared knowledge base, but also the degree to which that individual offers creative, exploratory input, which in turn promotes greater group creativity.

Furthermore, the greater the difference between the most expert and least expert member’s exploratory influence, the greater the effect. It can be hypothesized that when the expert member emerges as a leading participant, and the least expert is more inhibited from participating, there will be less competition to be heard, which will result in less conflict. Furthermore, the least expert member’s ideas, which are likely to be of poorer quality, are less likely to accrue a cost on performance.
This result supports the literature that does present a relationship between the characteristics openness to new experience, extroversion, and self-esteem, and creativity. However, results of this study suggest that this relationship reflects the positive effects of neither the summative expression of these variables nor in the simple variability of these characteristics, but in both the variability and distribution of these variables. This result may help explain the inconsistency in literature concerning the effects of team composition variables.

The findings of this study demonstrate that groups in which the expert member presents the highest level of openness to new experience, extroversion, and self-esteem will demonstrate the strongest creative process. This result has strong implications for employers and team managers, as it provides guidance for how to design groups that are most likely to be highly creative in the group process. The team composition variables utilized in this study represent enduring, deep-level characteristics, which are relatively simple to measure using highly established self-report instruments that take little time and effort to administer. Furthermore, the pervasive nature of these characteristics suggests that group dynamics related to these constructs should be less sensitive to ongoing changes in the group climate. When a group has an emergent expert who leads the creative process, the group is likely to require less coordination and integration than a group with equally actively contributing creative individuals. Woodman, Sawyer, and Griffin (1993) suggest that the performance of groups with many highly creative individuals suffers unless the group is able to counteract the competitive milieu with strong team creativity-relevant processes. Groups with high variability in the
composition variables of this study may therefore require less dependency upon intra-group processes and performance should be more consistent, even as groups experience shifts in the group climate. Although team creativity-relevant processes are likely to be beneficial even in groups with strong variability, because they subsume energy these processes are likely to falter with fatigue, and therefore groups that can maintain effective functioning without regulation of group processes are preferable.

Results of this study also indicate a significant direct relationship between group creativity and group-added value. This result supports the literature concerning the positive effects of group creativity on group performance. In this study, the group creative process enabled groups to make group decisions that exceeded in quality the decisions made by each individual member prior to engaging in the group process. Therefore, the group creative process allowed the group to perform above and beyond the performance of even the most expert and creative member. The fact that group-added value resulted from the group creative process debunks the idea that less-contributing members of the group are redundant. Though the expert plays a valuable role in facilitating the group, the other members are just as valuable as the creative process unfolds. In other words, though the expert mediates creative exploration, other members propel the process forward by building off of and evaluating these ideas.

Furthermore, as this study demonstrates, the importance of group creativity is not limited group tasks intended to generate creative products, but is also an essential ingredient in problem-solving tasks of various types. For instance, this study
demonstrates positive effects of the group creative process on a group’s ability to make quality decisions taken from a spread of options.

This study introduces two contributions to the literature on group creativity. The first of these contributions is the availability of a model and subsequent measure of the group creative process. Because the majority of studies on group creativity rely on evaluation of a creative product, as rated by a neutral expert in the relevant area, it has been virtually impossible to research the creativity of groups engaging in decision-making for which a the creativity of a decision is difficult to assess. Indeed, the research on the effects of group creativity in problem-solving tasks with little face value of requiring creativity has generally been overlooked. The availability of the current assessment measure, as based on the developed model of creativity, may allow further research to focus on the creative process as the level of analysis. In this way, the creativity of problem-solving and decision-making groups may be easier to evaluate.

A second contribution of this study is the introduction of a new latent variable, expert-mediated exploration. To the author’s knowledge, no prior studies have utilized a variable of this nature in reference to group creativity or group performance. In this study, a group’s creative potential was incumbent upon the expert member’s propensity to provide creative input for the group process. The use of the variable expert-mediated exploration has implications for future group research on team composition, group creativity, and group performance.
Limits of the Study

Participants in this study were students at a university in the Pacific Northwest. This population presents minimal diversity in terms of age, gender, race, and culture. The results of research on group creativity are most targeted toward organizations, where the population is generally older, more diverse, and depending on the organization either more or less accustomed to group work. Therefore, the results of the current study may not generalize to samples taken from organizations.

This study was conducted in a laboratory setting at the aforementioned university, where the students knew that they were participating in research on group-decision making. Bell (2007) found that personality factors were related to team performance in field settings, but showed little effect on performance in lab settings. Though this study was able to demonstrate effects in a lab setting, this factor can still be seen as a limitation of the study, as results may have been stronger in-vivo.

An additional limitation of the study is the use of a measure of group creative process that is not previously established in the literature. Because this measure has not been used in prior research and relays information about the process rather than product of creativity, it may be more challenging to compare the results to other studies of group creativity, which tend to focus on ratings of creative products.

Suggestions for Future Research

Results of this study bring to the foreground a number of interesting future directions for research on group creativity. The first of these suggestions is further investigation of the relationships between expert-mediated exploration and team
creativity-relevant processes. Theoretically, team creativity-relevant processes will be less important in groups with a dominant creative member, as in those with strong expert-mediated exploration (Taggar, 2001). However, intuitively it would seem that even in productive groups with fewer dominant creative participants, team creativity-relevant processes should benefit the group’s performance. Therefore, it would be interesting to investigate the mediating or moderating role of team-creativity-relevant processes in the relationship between expert-mediated exploration and group creativity. Furthermore, it may be important to examine the role of negative group processes in this relationship.

Because the majority of studies on group creativity determine a measure of creativity as based on a product, it may be interesting to examine the relationship between expert-mediated exploration and creative products. Such research would help to determine if expert-mediated exploration’s effects on decision-making task performance are different from the effects on the generation of novel products. Furthermore, such research would help shed light on the relationship between the creative process and actual creative production. As discussed in the introduction, the creative process may not always be predictive of creative performance in the form of products, as groups with high creativity may ultimately end up choosing a product that is not as creative as the process was.

Another future direction suggested by this study is to assess how explicit awareness of the group expert influences the group creative process and resulting performance. Furthermore, it may be interesting to examine how explicit cuing of creative problem solving affects group creativity and performance. In this study, groups
were not informed that they would be evaluated in terms of creativity. The survival task in which they participated did not have the appearance of requiring creativity, but simply appeared to solicit knowledge about survival skills and good judgment. Creativity on such tasks arose spontaneously as groups worked together to decide how the items could be used most resourcefully. It may be useful to examine the indirect effects of expert-mediated exploration on group performance when the creativity of the task is more apparent. For instance, in future research using similar tasks instructions may be included to think creatively about how the items could be used to aid survival, rather than just to rank them in the order of most and least importance.

**Conclusions**

In summary, results of this study uncover a number of interesting findings related to group composition factors that predict group creativity and the effects of group creativity on group performance. Direct effects were found between expert-mediated evaluation and group creativity and between group creativity and group-added value. These direct effects exceeded the direct effect of expert-mediated exploration and group-added value, suggesting that group creativity mediated this relationship. The team composition variables that this study evaluated- openness to new experience, extroversion, and self-esteem- can be readily measurable using highly established measures, and such knowledge could be used to inform initial stages of team development. Because these groups are inherently likely to function more effectively, the degree to which they rely on creativity-relevant processes and require continued monitoring should be substantially reduced. Therefore, developing groups in which the
expert has the greatest propensity to mediate the explorative process could be very valuable for organizations invested in facilitating creative groups. Optimizing the creative process in group tasks, in turn, has positive implications for organizations in the competitive market, where productivity and strong decision-making is pivotal to success.
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