Creative Personality, Process, and Product

A Mixed Method, Mixed Measure Analysis of Team Creativity

Gerald F. Burch[a], John H. Batchelor[b], and Jana J. Burch[c]
[a]Faculty of Business Management, Virginia State University
email: gburch@vsu.edu
[b]Faculty of Business Management, University of Western Florida
email: jbatchelor1@uwf.edu
[c]Davinci Studies
Email: jana@davincistudies.com

Abstract

Team creativity research has significantly lagged behind the research conducted on individual creativity. This fact is magnified by the current use of creative teams to solve the most challenging problems in organizations. We performed a mixed method, mixed measure analysis of 128 teams comprised of 349 university students and 97 working adults to address the gaps in creative personality, creative process, and creative product research.

Our results indicate that the inclusion of creative personality and divergent thinking components significantly adds to the ability to predict which teams will produce the most creative products. Using hierarchical regression, we show that creative ability and divergent thinking (in particular fluency and originality) increase the total variance explained from .18 for cognitive ability and five factor personality to .65 with our new variables. We use our predictive model to provide significant implications for international and managerial professionals.

Introduction

Organizations must quickly adapt in today's constantly changing, globally competitive environment. Yesterday's winning ideas are rarely valid today. Therefore, creativity and innovation have become critical to the performance, growth, and survival of organizations [1]. Since organizations themselves are not creative, the value associated with innovation and creativity comes from the work of highly-creative people [2]. Managers have tried to capitalize on this phenomenon by selecting employees based on their attributes [3]. Scholars have assisted by researching the most important individual personalities [4], processes [5], and places [6] that generate the most innovative products [7]. However, this increased globalization and competition, and a movement towards a knowledge-based economy are so complex that a single individual does not possess all the knowledge necessary to solve these complex problems for their organization [8]. As a result, companies have focused on the team to solve these problems.

Much has been learned about individual creativity and yet team-level creative problem solving remains under-researched [9]. A current study shows that despite the calls for increased team research, little has occurred over the past fifteen years [10]. The need still exists for researchers to unravel the group traits, skills, and processes that are necessary to arrange the perfect cast of participants for creative problem solving teams.

The purpose of this study is to systematically examine how team personality, team traits, and team processes affect the development of creative products. We will explore this area of team creative problem solving through the use of a mixed method, mixed measure approach. We base our research on Amabile's [11] componential theory of creativity which states that creativity is a result of task motivation, domain-relevant knowledge, and creativity-relevant skills. We build on this componential theory by identifying the most important group traits, abilities, and processes to the development of innovative group products.

Our study contributes to the creativity literature, and to the broader field of team and organizational behavior, by expanding one of the most highly cited team creativity studies. Taggar [12] presented a multilevel latent model of team performance that showed the importance of individual personality and cognitive ability on group creativity. Our research extends this seminal research in three areas. First, we include a measure of team creative personality as a potential predictor not identified by Taggar [12]. Previous research has focused primarily on the use of a five factor model of personality [13]. Our research indicates that a separate dimension, creative personality [14], has often been neglected in management research in spite of the variable's predictive ability in creative studies.

Second, we extend the analysis of creative process to include both convergent and divergent thinking. The process of creative problem solving is a combination of divergent and convergent thinking [15]. Divergent thinking is the creative sub-process that leads to the generation of ideas [5] and convergent thinking is the complementary evaluation and selection of those products. Our research adds to the understanding of team processes by dissecting divergent thinking into its four subcomponents (fluency, flexibility, originality, and elaboration).

Third, we evaluate the team product using multiple measures. Research on idea generation and the usefulness of idea generation methods, like divergent thinking, have received much more attention than idea evaluation [16]. We explore this gap in management innovation literature by systematically evaluating the team product for novelty, resolution, and style [17].

Our research design is based on the Mumford, Hester, and Robledo [1] argument that studies that combine mixed method, mixed measures are highly valuable. Creativity research is often categorized by four methods used to conduct studies and five measures of performance [1]. Our research includes three measures and three methods to evaluate how creative personality and creative process are used to develop creative products. Our mixed method, mixed measure approach provides valuable insight on team creativity.

Finally, our results demonstrate how team creative personality and team processes add incremental explanatory power above that which is explained by the team's five factor model personality and their cognitive ability on the development of creative products. This identification of the most dominant personality traits and processes provide international researchers and managers greater insight into the identification and selection of participants needed to produce the most creative products.

Literature Review and Hypotheses

Following prior research, we define creativity as the production of high quality, original and elegant solutions to problems [18]. Mumford and his colleagues [1] argued that this definition implies that creative work is the outcome of creative problem solving. From this standpoint, creativity is the outcome and creative problem solving is the process. Using these definitions, we base our research on Amabile's [11] componential theory of individual creativity

which claims that individuals must be motivated to use their domain-relevant skills and creative-relevant cognitive processes to produce a novel product. Implied in this theory is a multiplicative model where all three key elements (motivation, domain relevant skills, and creative relevant processes) must be present to produce creative products. According to the componential theory of individual creativity, motivation is both a state and relatively stable trait related to personality [19]. Taggar [12] and others have relied heavily on the five factor model [13]. We believe that there are distinct creative personality attributes that add further explanation to why individuals would engage in creative problem solving.

The domain-relevant skills component of Amabile's theory can be viewed as the ability of the individual to learn the tasks associated with their jobs [11] and that creative-relevant cognitive processes are a combination of cognitive ability and learned creative processes. In much of the previous innovation literature, general cognitive ability [12] has been used as a predictor of both domain relevant skills and creative processing skills. We argue that this approach has caused researchers to look specifically at those attributes of creative relevant skills that are closely tied to general cognitive ability while ignoring other creative abilities. In particular, an individual' cognitive ability is related to both convergent and divergent thinking. In our research design we further investigate how divergent thinking may be a combination of general cognitive ability and learned creative relevant skills.

Our final area of investigation is built around the evaluation of the product. Managers often ask creative problem-solving teams to generate solutions to problems without stating a designed rubric for assessing the value of the product. In a similar fashion, management research has often used single measure evaluation for the creative product. We propose that the value of a creative solution may differ based on the desired outcome of the person who has sponsored the team. Creativity research should therefore find means of evaluating creative products using multiple dimensions. In the next few paragraphs we will examine the three gaps in creativity research we have previewed in this introduction.

Personality and Creativity

Research and practice has shown that the right people, in the right environment, using effective social and cognitive processes, can become highly innovative teams [20]. We start to solve which people are the right people by looking at individual personalities and then extend this to the group level. One obvious complexity added to group analysis is the necessity to determine how to measure team attributes. We will follow the lead of other creativity researchers and average each personality variable across team members [21].

Creative personalities have been studied among common and highly creative participants [22] to identify personality characteristics that are associated with individuals who have high creativity scores [23]. Some of these characteristics include self-confidence, enthusiasm, hard-working, tolerance for ambiguity, risk-taking, emotional, hostile, and bitter. This wide array of descriptive characteristics has also led to contradiction in the descriptions given of creative persons [24]. To best analyze these characteristics, and to make sense of these contradictions, it is imperative to place them into two groups. The first group of characteristics we will consider will be those included in the five-factor model [13] and the second group will include those characteristics that are not in the five-factor model.

The prevailing measure of personality in management literature has been based on the five-factor model [13] which identifies conscientiousness, agreeableness, neuroticism, openness to experience, and extraversion as the most prevalent stable personality traits. At the individual

level, studies using the five-factor model have consistently found that creativity is positively associated with openness to experience and negatively related to conscientiousness [25]. Explanations for these relationships include the belief that creative people use their openness to new ideas and experiences to find new ways to solve problems, and therefore generate more creative ideas. Conversely, conscientious individuals often have highly restrictive rules that may impede the problem-solving process which may cause them to never consider novel solutions. The remaining three factors of the five-factor model have shown weaker and more varied results. Research has shown that creative people are low on agreeableness, low on extraversion, and high on neuroticism [24]. The mixed results for some of the factors may be attributed to multiple components being measured by the factor. An example is extraversion which has a confidence component that measures ambitiousness and a sociability component that captures the individual's social interaction preferences [26]. The importance of these multiple components may be more pronounced when comparing the relationship between the factors and individual creativity as compared to group aggregated factors and their relationship to group creativity.

Team personality studies have also analyzed elements of the five-factor model [13], but only a limited number of studies are available [8]. One study revealed a negative link between team conscientiousness and group creativity [4] while a second indicated that groups with some extraverted members outperformed groups with no-extraverted members [27].

Based on the results of individual and group personality studies, we expect that team personality attributes will be related to team creative product development.

Hypothesis 1a. Groups with a higher average openness to experience will produce more creative products than groups with lower average openness to experience.

Hypothesis 1b. Groups with lower average conscientiousness will produce more creative products than groups with higher average conscientiousness.

Hypothesis 1c. Groups with lower average neuroticism will produce more creative products than groups with higher average neuroticism.

Hypothesis 1d. Groups with higher average extraversion will produce more creative products than groups with lower average conscientiousness.

Hypothesis 1e. Groups with higher average agreeableness will produce more creative products than groups with higher average agreeableness.

Our second group of personality characteristics includes those personality attributes not included in the five-factor model. A meta-analysis of creativity and personality literature found that additional factors account for some degree of individual creative performance [26] and that team creativity is a complex phenomenon where other personality factors affect team creativity [28]. These additional factors include tolerance for ambiguity, self-confidence, intuition, resistance to closure, less conventional, driven, ambitious, hostile, and impulsive. At question is whether any of these new traits may affect the development of creative products. Amabile's componential model claims that the individual must be motivated to engage in creative problem solving. It is possible that an individual's self-confidence will cause an individual to be more motivated to be creative. Similarly, it is anticipated that more ambitious individuals will be more motivated and strive to develop more creative products. We propose that even though these attributes are not commonly researched in the five-factor model, that they are still relevant to the development of creative products.

One means of measuring these attributes is to analyze the individual's creative personality [14]. Creative personality has been tested empirically and employees that scored

higher on scales that measured creative personality produced more creative work [29]. Based on this study we anticipate that the same processes that are present at the individual level will be identified at the group level for creative product development.

Hypothesis 1g. Groups with a higher average creative personality will produce more creative products than groups with lower average creative personality.

Since most previous research has not included a measure of creative personality, it is anticipated that they may have overlooked a personality dimension that may be vital to evaluating group product creativity. We will look specifically at whether this construct adds incremental explanation that previous studies may have inadvertently omitted.

Hypothesis 1h. Increased average group creative personality positively affects group product creativity above what is explained by the five-factor model.

Creative Process

Creative problem solving cognitive processes have received much more attention at the individual level than at the group level [30]. This is evidenced by lack of cognitive process inclusion in a meta-analysis which includes variables influencing team creativity [31]. One exception to this stream of research is the extensive focus on brainstorming, which is one form of idea generation. However, to understand the relationship between team creative personality and team processes we will return to Amabile's [11] componential model.

In the previous section we showed that Amabile's first element, motivation, was connected to personality. Her two remaining elements, domain specific knowledge and creative relevant skills, are related to cognitive ability. Taggar [12] demonstrated that one link between general cognitive ability and creativity rests in the relationship between general cognitive ability and domain relevant skills. Individuals with a greater cognitive capacity will often become better masters of their domain knowledge. This will increase the domain specific knowledge and therefore increase product creativity based on the multiplicative model. Using a similar line of reasoning it could be argued that creative relevant skills are also learned, which would mean that they are subject to the cognitive capacity of the individual. Most creative research has taken this approach and limited the evaluation of creative processes to being specifically built around general cognitive ability. We propose that this approach potentially omits other variables because it does not consider the complex nature of creative thought.

The production of high quality, original, and elegant solutions to problems requires individuals and groups to develop ideas and then select ideas considered to be the most creative or best fit for the situation. The process of generating creative responses is a combination of divergent thinking [15] which is often referred to as ideation, and the evaluation and selection of those ideas through convergent thinking. We will first focus on convergent thinking and then return to the more complex task of divergent thinking.

Idea evaluation requires individuals to logically, or systematically, review the attributes of each potential creative solution and to select ideas based on those attributes. Since people with higher general cognitive ability are better at processing information [32], it is anticipated that individuals with higher cognitive ability will be better at convergent thinking, and therefore produce more creative products. We conclude that many creative researchers stop at this point.

To many people, divergent thinking has been considered a theory of originality. This is a simplified misconception based on only one dimension of the construct. Divergent thinking describes the processes that individuals use to generate new ideas [5]. It is a combination of

cognitive processes adopted by individuals to produce many and varied ideas. In the divergent thinking process, the individual will use learned schemas for generating ideas. The level of an individual's general cognitive ability will certainly affect their divergent thinking ability since an individual must learn creative processes. However, educational research has shown that divergent thinking abilities can be improved through training individuals to better use effective idea generating schemas. This means that a person's divergent thinking ability may be due to factors other than just general cognitive ability. We will explore this idea further in this section. First, we focus on the effect that divergent thinking has on the development of creative products.

Divergent thinking attributes include fluency, flexibility, originality, and elaboration. One of the major contributions of this research is to further identify which of the divergent thinking elements contributes the most to the production of creative products. We will examine all four elements by starting first with fluency which measures the number of non-redundant ideas, insights, problem solutions, or products generated [15, 33] during the creative process. Individuals that can produce more ideas will have a larger set of ideas to choose from when they engage in the convergent thinking process of selecting their best idea. Producing more ideas often results in producing more creative ideas. It is anticipated that an individual's ability to produce more ideas will increase their ability to produce creative products. It is also anticipated that these same processes will be present at the group level.

Hypothesis 2a. Groups with higher average fluency ability will generate more creative products than groups with lower average fluency ability.

Flexibility is demonstrated when different domains or perspectives are used to develop creative ideas [11]. It is measured by evaluating the number of different approaches that the individual takes to solving the problem [34]. Increased flexibility enables the individual to look at a problem from various angles which can increase product creativity. Individuals that have a greater degree of flexibility will therefore be expected to generate more creative products. Similarly, teams that have members with higher levels of flexible thinking will generate more creative group products

Hypothesis 2b. Groups with higher average flexibility in solving problems will generate more creative products than groups with lower average flexibility in solving problems.

Originality is the single dimension of divergent thinking that is often most related to the creativity itself. However, originality only measures the degree to which an idea is uniquely different from other ideas [15]. Originality can be obtained by generating the idea, through elaboration on a previously generated idea, or using flexible thinking to alter a previously generated idea. Individuals who are better at producing original ideas will generate more creative products. It is expected that the same process is true at the group level.

Hypothesis 2c. Groups with higher average originality abilities will generate more creative products than groups with lower average originality abilities.

Elaboration identifies an individual's ability to add details to products, ideas, or creative solutions [34]. Elaboration occurs after one idea is generated. In this manner the individual begins with the idea and then modifies it by attaching a complimentary element. The ability to elaborate allows individuals to develop more creative products. Groups are expected to use a similar process.

Hypothesis 2d. Groups with higher average elaboration ability will generate more creative products than groups with lower average elaboration ability.
Hypothesis 2e. Groups with a higher average divergent thinking ability will produce more creative products than groups with lower average divergent thinking ability.

Research design and data collection

Our research design provides a mixed method, mixed measure analysis of team creativity. We administered self-report surveys to assess personality (five factor model and creative personality), gathered cognitive ability from archived data, and asked respondents to complete a divergent thinking assessment which was scored by expert raters. Our sample consisted of 446 respondents, 349 undergraduate students and 97 working adults. These respondents comprised 128 groups (54% male, average age of 22). The students were from a large southeastern public university, the working adults were volunteers from a private firm headquartered in Texas. It was anticipated that volunteers would score higher on divergent thinking since individuals who considered themselves as having lower creative skills would not volunteer for the study. The purpose of using both students and working adults was to ensure that similar processes are at play in both educational and work settings. Identical measures were administered to all. To determine if combining the two categories of respondents was acceptable, an analysis of the two groups was performed for the key variables in this study. There was no statistically significant difference between the categories of respondents for creative personality ($F = .78$, $p = .38$), and with three components of divergent thinking; originality ($F = 1.21$, $p = .27$), flexibility ($F = 2.59$, $p = .11$), and verbal ($F = .34$, $p = .56$). However, as expected, there was a statistically significant difference between the divergent thinking categories; fluency ($F = 20.73$, $p = .00$), elaboration ($F = 27.45$, $p = .00$), and figural ($F = 4.87$, $p = .03$). We believe that the categories of respondents are similar enough for the purposes of this study.

In this study, respondents were randomly assigned to groups of three to four members. Groups were asked to "find an uncommon use for aluminum foil." Each team was given 15 minutes to generate and select their best idea. The dependent variable in this study is the level of product creativity developed by the team. We used the Creative Product Analysis Matrix (CPAM) [17] to assist raters on scoring the most relevant attributes on deliverables such as products or ideas [35]. The CPAM consists of three dimensions: novelty, resolution, and style. Two experienced evaluators assessed each product and results were compared. The interrater reliability was .98, indicating that there was adequate agreement between raters. The two independent variables of most concern in this study were creative personality and divergent thinking ability. We also used two control variables: personality and cognitive ability.

Creative Personality. Gough's [14] creative personality scale was used in this study. This scale is an adjective checklist comprised of 30 items. Respondents are asked to "Place a check mark next to each adjective that you think describes you." Of the 30 items, 18 are associated with creative people; the remaining 12 are representative of attributes associated with less creative people. Oldham and Cummings [29] report a alpha reliability of .70 for this measure.

Creative ability – Divergent thinking. The ATTA is a shortened version of the original Torrance Test of Creative Thinking (TTCT) [33]. The TTCT has been widely used in creative research for over the past 40 years and has consistently been shown to validly predict creative performance. The ATTA assesses four creative abilities: fluency, originality, elaboration, and flexibility. Fluency is scored as the number of ideas generated. Originality is scored based on how unusual the response provided is relative to established responses. Elaboration is scored by

assessing the amount, quality, and rarity of detail provided. Flexibility scores are based on how well respondents performed on non-traditional use of drawings, absence of rigidity, and adjusting approaches. Scoring of the ATTA for respondents was conducted by using two experienced raters. Alpha reliabilities for the four dimensions of the ATTA, fluency, originality, elaboration, and flexibility were .99, .97, .97, and .99 respectively. These reliabilities are all within the normal range .95 to .99 reported in the ATTA manual [36].

Personality. The Mini International Personality Item Pool (Mini-IPIP) [37] was used to measure the big five personality traits of openness, extraversion, agreeableness, and neuroticism. The Mini-IPIP is a shortened 20 item version of the original 50 item International Personality Item Pool (IPIP) ~~developed by Goldberg [38]~~. It uses four items to measure each of the five personality traits. The alpha reliabilities for openness, conscientiousness, extraversion, agreeableness, and neuroticism in this study are .75, .67, .82, .86, and .70 respectively.

Cognitive ability. Cognitive ability was proxied with standardized test score averages for all available participants.

Data Analysis and Results

Hierarchical regression analysis was used to test the primary hypotheses of this study. Three models were used and the results are presented in Table 1. Model 1 is the control model and contains cognitive ability and the big five personality traits of conscientiousness, agreeableness, neuroticism, openness, and extraversion. Creative personality (CPS) was added in Model 2 and the creative relevant skills (ATTA components) were added in Model 3. Group Correlations for all variables are shown in Table 2.

Table 1. Group Level Results for Creative Performance

Variable	Model 1 Control Variables	Model 2 Control and CPS	Model 3 Control, CPS, and ATTA
Conscientiousness	-.697	-.308	.183
Agreeableness	1.218	1.131	.964
Neuroticism	.332	-.819	-.700
Openness	.684	-.903	-.912
Extraversion	.320	-.602	-.241
Cognitive Ability	3.940***	3.346***	3.164***
CPS		1.187***	.938***
Fluency			1.197**
Originality			.356
Elaboration			-.181
Flexibility			-.721*
Verbal			-.021
Figural			.306
Model df	6	7	13
Model R^2	.182	.542	.650
R^2 Change	.182**	.359***	.109**

*p < .05, **p < .01,***p < .001, Value in cells are unstandardized coefficients

Hypotheses 1a, 1b, 1c, 1d, and 1e predicted that the big five personality factors would be related to the creativity of the team product (novelty, resolution, and style). The results from the hierarchical regression and the zero-order correlations support the direction predicted by the hypotheses, but none of the results reach the .05 level of significance. Therefore, these hypotheses were not supported.

Hypothesis 1f argued that the team creative personality would be positively related to the creativity of the product developed. Table 2 indicates that all three components of product creativity had a positive and significant correlation with average team creative personality. Hypothesis 1f is therefore supported.

Hypothesis 1g predicted that creative personality would add predictive ability above and beyond that which was predicted by the five factor model and also cognitive ability. This was tested in Model 2 of the multiple regression analysis. Creative personality has a positive and significant regression coefficient ($B = 1.187$, $p < .001$) and there is a significant R^2 change (.359, $p < .001$) between Model 1 and Model 2. Hypothesis 1g is therefore supported.

Table 2: Group Correlations

	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Conscientiousness	4.76	0.83													
2. Agreeableness	5.45	0.56	.23**												
3. Neuroticism	4.57	0.72	.19*	.13											
4. Openness	5.37	0.66	-.18*	-.05	.07										
5. Extraversion	4.71	0.97	-.24**	-.10	-0.15	.10									
6. Grade	.12	0.54	.14	.02	.17	.00	-.16								
7. CPS	5.34	3.09	-.14	-.01	.21*	.34**	.24**	.08							
8. Fluency	16.26	1.60	-.18*	.15	-.00	.12	-.13	.04	.23**						
9. Originality	16.86	1.46	.11	.01	.15	-.03	.02	.23*	.34**	.31**					
10. Elaboration	16.18	1.64	-.17*	.05	-.14	.33**	.12	.09	.01	.51**	-.13				
11. Flexibility	15.57	1.48	.08	.27**	.00	-.05	-.14	.00	-.03	.56**	.01	.35**			
12. Novelty	4.24	2.06	-.11	.06	.09	.18	.01	.34**	.59**	.38**	.39**	.15	-.02		
13. Resolution	4.17	1.79	-.06	.13	.12	.09	.01	.30**	.63**	.41**	.51**	.04	.02	.86**	
14. Style	4.17	1.78	.02	.10	.12	.04	.04	.35**	.60**	.40**	.47**	.09	.04	.83**	.95**

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

Hypotheses 2a through 2d predicted that there would be a positive relationship between the dimensions of divergent thinking and the development of creative products by teams. Fluency (hypothesis 2a) and originality (hypothesis 2b) had positive and significant correlations with all three components of team creativity. Elaboration (hypothesis 2c) and flexibility (hypothesis 2d) did not have significant correlations with the team creativity components. Hypothesis 2a and 2b are supported. Hypothesis 2c and 2d are not supported.

Hypothesis 2e predicted that creative ability, as observed by divergent thinking ability, would add predictive ability above and beyond that which was predicted by the five factor model and also cognitive ability. This was tested in Model 3 of the multiple regression analysis. Two components of divergent thinking ability have significant regression coefficients (fluency, $B = .631$, $p < .001$; originality, $B = -.528$, $p < .001$) and there is a significant R^2 change (.123, $p < .001$) between Model 2 and Model 3. Hypothesis 2e is therefore supported.

Discussion and Conclusion

The results from this study advance the research on team creativity on three major fronts. Our first contribution comes from the identification of an important personality attribute for predicting team creativity. Most previous research had focused on using the five factor model to depict the personality attributes that are significant in team creativity. Our research showed that these five dimensions are important. However, the more important personality element is creative personality. It is anticipated that creative personality is associated with Amabile's [11]

motivation component for creative performance. Our results showed that the five factor model and cognitive ability predicted approximately 18 percent of the variance for team creative performance. When creative performance was added to the multiple regression, the R^2 of the model increased from .182 to .542. Creative personality therefore adds approximately 36 percent more explanatory power for creativity researchers.

A second major contribution of this research is the dissection of creative ability into creative ability components [11]. Our research design separated creative relevant skills into convergent thinking and divergent thinking. Using a proven means of assessing individuals for divergent thinking ability, we were able to show that divergent thinking ability further increased the predictive ability of our model from .542 to .650. Included in this analysis was that fluency and originality were significant contributors, but that elaboration and flexibility do not appear to be as important at the group level.

Our final contribution comes from the inclusion of multiple dimensions of creative product evaluation. We did not have specific hypotheses related to the relationships that the independent variables would have with novelty, resolution, and style of the product. However, the results from our study show that the three dimensions vary across the predictive variables.

We conclude from this study that future research should include creative personality, divergent thinking, and multiple measures of the creative product for future team creativity research. Our research design was able to show significant contributions to the explanatory model while controlling for the most important variables in organization behavior and creativity research (five factor personality and cognitive ability). Our evaluation of divergent thinking also indicates that creative ability is not just a function of cognitive ability. Individuals develop creative abilities. This fact has significant implications for managers.

International and Managerial Implications

The results from this research are important to international and management professionals based on all three areas of our research: creative personality, creative process, and creative product. Our identification of creative personality as a key indicator of team creative performance allows human resource managers a means of easily identifying and hiring for the potential to perform creative work. In addition, creative personality allows managers a means of identifying which members may perform well on creative problem solving teams. A second contribution is the identification of divergent thinking skills, primarily fluency and originality, as key individual creative abilities that contribute significantly to the team creative product. Many of the divergent thinking tests require expert raters to accurately determine the creative ability of the individual. Our results show that the two easiest elements to assess, fluency and originality, are the two most important to team creativity. This result will allow international and management professionals to develop simple divergent thinking assessments that can be easily scored by human resource members. Identifying individuals inside the company, and also potential new employees, by their ability to produce many original ideas will provide managers with valuable information about which members to include on creative problem solving teams.

A final contribution for international and managerial professions is the understanding that various creative personality and creative processes are in play when groups are asked to develop creative products. The personalities and processes needed to develop products with a high degree of novelty are different than if the product must have a higher degree of resolution. Managers must determine before launching a creative problem solving team if they desire their

product to have more novelty, resolution, or style. Once defined, the manager is now more capable of determining which members to include on their team based on our research.

References

1. Mumford, M. D., Hester, K. S., & Robledo, I. C. (2011). Methods in creativity research: Multiple approaches, multiple levels. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 39-65). Oxford, UK: Elsevier.
2. Florida, R. (2004). America's looming creativity crisis. *Harvard Business Review*, 82, 122-136.
3. Farr, J. L., (1990). Facilitating individual role innovation. In M. A. West & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 207-230). Chichester, England: Wiley.
4. Robert, C., & Cheung, Y. H. (2010). An examination of the relationship between conscientiousness and group performance on a creative task. *Journal of Research in Personality*, 44, 222-231.
5. Acar, S., & Runco, M. A. (2011). Creative abilities: Divergent thinking. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 39-65). Oxford, UK: Elsevier.
6. Hirst, G., Van Knippenberg, D. V., Chen, C., & Sacramento, C. A. (2011). How does bureaucracy impact individual creativity? A cross-level investigation of team contextual influences on goal orientation-creativity relationships. *Academy of Management Journal*, 54, 624-641.
7. Welling, H. (2007). Four mental operations in creative cognition: The importance of abstraction. *Creativity Research Journal*, 19, 163-177.
8. Reiter-Palmon, R., Wigert, B., & Vreede, de T. (2011). Team creativity and innovation: The effect of group composition, social processes, and cognition. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 295-326). Oxford, UK: Elsevier.
9. Kurtzberg, T. R., & Amabile, T. M. (2001). From Guilford to creative synergy. Opening the black box of team level creativity. *Creativity Research Journal*, 13, 285-294.
10. James, K., & Drown, D. (2011). Organizations and creativity: Trends in research, status of education and practice, agenda for the future. In M. D, Mumford (Ed.), *Handbook of organizational creativity* (pp. 17-38). Oxford, UK: Elsevier.
11. Amabile, T. M. (1996). *Creativity in context.* Boulder, CO: Westview Press.
12. Taggar, S. (2002). Individual creativity and group ability to utilize individual creative resources: A multilevel model. *Academy of Management Journal*, 45, 315-330.
13. Costa, P. T., & McRae, R. R. (1992). *NEO-PI-R: professional manual.* Odessa, FL: Psychological Assessment Resources.
14. Gough, H. G. (1979). A creative personality scale for the Adjective Check List. *Journal of Personality and Social Psychology*, 37, 1398-1405.
15. Guilford, J. P. (1967). *The nature of human intelligence.* New York, NY: McGraw-Hill.
16. Puccio, G. J., & Cabra, J. F. (2011). Idea generation and idea evaluation: Cognitive skills and deliberate practice. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 189-215). Oxford, UK: Elsevier.
17. Besemer, S. P., & Treffinger, D. J. (1981). Analysis of creative products: Review and synthesis. *The Journal of Creative Behavior*, 15, 158-178.
18. Mumford, M. D., & Gustafson, S. B. (1998). Creativity syndrome: Integration,

application, and innovation. *Psychological Bulletin,* 103, 27-43.
19. Conti, R., Coon, H., & Amabile, T.M.. (1996). Evidence to support the componential model of creativity: Secondary analysis of three studies. *Creativity Research Journal,* 9, 385-389.
20. Paulus, P. B., Dzindolet, M., & Kohn, N. W. (2011). Collaborative creativity – group creativity and team innovation. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 327-357). Oxford, UK: Elsevier.
21. Stewart, G. (2006). A meta-analytic review of relationships between team design features and team performance. *Journal of Management,* 32, 29-55.
22. Hoff, E. V., Carlsson, I. M., & Smith, J. W. (2011). Personality. In M. D. Mumford (Ed.), *Handbook of organizational creativity* (pp. 241-270). Oxford, UK: Elsevier.
23. Barron, F. X. (1963). *Creativity and psychological health: Origins of personal vitality and creative freedom.* Princeton, NJ: Van Nostrand.
24. Eysenck, H. J. (1995). *Genius: The natural history of creativity.* Cambridge, UK: Cambridge University Press.
25. Batey, M., Chamorro-Premuzic, T., & Furnham, A. (2010). Individual differences in ideational behavior: Can the big five and psychometric intelligence predict creativity scores? *Creativity Research Journal,* 22, 90-97.
26. Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality & Social Psychology Review,* 2, 290-309.
27. Barry, B., & Stewart, G. (1997). Composition, process, and performance in small groups. The role of personality. *Journal of Applied Psychology,* 82, 62-78.
28. Baer, M., Oldham, G, Jacobsohn, G. C., & Hollingshead, A. B. (2008). The personality composition of teams and creativity: The moderating role of team confidence. *The Journal of Creative Behavior,* 42, 255-282.
29. Oldham, G. R., & Cummings, A. (1996). Employee creativity: Personal and contextual factors at work. *Academy of Management Journal,* 39, 607-634.
30. Reiter-Palmon, R., Herman, A. E., & Yammarino, F. J. (2008). Creativity and cognitive processes: Multi-level linkages between individual and team cognition. In F. Dansereau & F. J. Yammarino (Series Eds.) *Research in multi-level issues: Vol. 7. Multi-level issues in creativity and innovation* (pp.203-267). Bingley, UK: Emerald Publishing Limited.
31. Hulsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. *Journal of Applied Psychology,* 94, 1128-1145.
32. Schmidt, F. L., Hunter, J. E., & Pearlman, K. (1981). Task differences and the validity of aptitude tests in selection. A red herring. *Journal of Applied Psychology,* 66, 166-185.
33. Torrance, E.P. (1966). Torrance test of creative thinking: Norms technical manual (Research ed.). Princeton, NJ: Personnel Press.
34. Torrance, E. P. (1995). *Rewarding creative behavior.* Englewood Cliff, NJ: Prentice-Hall.
35. Besemer, S. P., & O'Quin, K. (1999). Confirming the three-factor product analysis matrix model in an American sample. *Creativity Research Journal,* 12, 287-296.
36. Goff, K., & Torrance, E.P. (2002). The abbreviated torrance test for adults (ATTA). Bensenville, IL: Scholastic Testing Service.

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