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Is Structured Creativity an Oxymoron? The Effects of Moderate Task Structure on Virtual and Face to Face Team Creative Output

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Is Structured Creativity an Oxymoron? The Effects of Moderate Task Structure on Virtual and Face to Face Team Creative Output

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Abstract

Creativity researchers have proposed that collaboration is necessary for creativity (Amabile & Khaire, 2008), and note that freedom of process is necessary to increase idea generation (Amabile, 1983). Although some research has shown freedom produces greater creativity compared to constraints (Choi et al., 2009; Gilson, Mathieu, Shalley & Ruddy, 2005), a handful of studies have shown that having constraints may be beneficial for creativity teams (Abric, 1971; Dennis, Valacich, Connolly, & Wynee, 1996; Dennis & Valacish, 1999). Constraints may be particularly beneficial for virtual teams to increase their communication and coordination efforts, as these processes differ from face-to-face teams. The present study evaluated the relationship between virtual teams and face-to-face teams and creativity, and whether different degrees of task structure moderate creative output. Results from the study indicated all relationships were non-significant. Limitations and implications from the results are discussed.

Keywords: creativity, novelty, usefulness, divergent thinking, virtual teams, face-to-face teams, task structure, standardization, formalization

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Chapter I: Introduction and Review of Literature

New products, processes or services assist organizations in starting and sustaining a business (Amabile & Khaire, 2008). These innovative outcomes are first transpired with creative ideation (Zhou & Hoever, 2014). To produce innovative products, processes or services, organizations need to concatenate people and their processes to foster creative output – defined as an idea that is both novel and useful (Amabile, 1983; Parjanen; 2012; Paulus, 2000; Runco & Jaeger, 2012; Zheng, Proctor, & Salvendy, 2011) – a necessary antecedent to innovation (Zhou & Hoever, 2014). Collaboration can increase creativity and innovation because it allows opportunity to discuss an issue using multiple perspectives (Amabile & Khaire, 2008). Collaboration promotes input from multiple backgrounds (e.g., knowledge domains and ethnic diversity) (Amabile & Khaire, 2008; Kurtzberg, 2005; McLeod, Lobel, & Cox, 1996; Paulus, 2000), increasing the chance that individuals will be exposed to others' ideas (Fink et al., 2012).

Forming teams may enhance creative collaboration efforts to increase innovation and organization's competitive advantage. The process of creative collaboration literature has focused on contextual characteristics such as formalization or standardization. Formalization and standardization (hereafter referred to as task structure) are process characteristics that refer to rules and processes in the planning of a task (Im, Montoya, & Workman, 2013). While some creativity literature has focused on process characteristics surrounding standardization or formalization of tasks (Dennis & Valacish, 1999; Gilson, Mathieu, & Shalley, 2005; Vafeas & Hughes, 2016), less research has focused on the impact of assigning task-structure to directly compare *different types of teams* (e.g., face-to-face teams and virtual teams) on creativity performance criteria (Zhou & Hoever, 2014). That is, to what degree do face-to-face teams and virtual teams produce creativity in general, and to what degree will the different team types produce creativity under imposed structure processes? The goal of the present research is to determine if different levels of task structure affects creativity among virtual and face-to-face teams.

The degree of a team's task structure may impact the novelty and usefulness of ideas produced. In other words, if task structure is too constricting, there is less freedom to produce something novel and

useful (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Choi, Anderson & Veillette, 2009). Some researchers have suggested that process constraints such as procedures and rules (task structure) reduce the variability of ideas (Gilson et al., 2005) and thus the creative possibilities teams and organizations can choose from for an innovative output. On the other hand, too much freedom may result in ambiguity and "chaos." Since teams are comprised of many individuals, they may benefit from some process constraints to help members communicate and be on the "same page" when it comes to their task (Guo, D'Ambra, Leenders, Turner, & Zhang, 2009; Hulsheger, Anderson, & Salgado, 2009). Instead of assigning a highly restrictive task structure, or not assigning any sort of task structure, it is proposed that a moderate task structure (i.e., a broad outline of steps/goals) may increase creative output. In other words, the relationship between creativity and task structure may be an inverted-U, where a moderate amount of structure will have the largest impact on creative output.

The purpose of this research is threefold. The first goal is to determine if virtual and face-to-face teams differ in generating creative output. The second goal was to decipher if imposing a moderate task structure improves a team's creative output generation over no task structure. Lastly, the third goal was to determine if imposing moderate structure increases creativity for virtual teams more than face-to-face teams. The following introduction first delves deeper into the broader concept of creativity and divergent thinking, next considers how researchers approach teams, and then utilizes goal setting theory to clarify how task structure is beneficial for teams. Next, situational strength and linear relationships on structure and creativity are discussed. Lastly, a summary of the literature on how an inverted-U relationship between structure and creativity (moderate structure) is more impactful for creative output compared to low or high task structure in teams is discussed.

Creativity

Creativity is considered to be an idea that is useful and novel (Amabile, 1983; Paulus, 2000; Parjanen; 2012; Runco & Jaeger, 2012; Zheng et al., 2011). In other words, something that is creative should be original - if someone has not imagined or developed this idea before, then it could give an

organization competitive advantage, but this idea ought to be useful – if an idea is not useful, it will not provide value (i.e., profit) to an organization. Because innovation is necessary to increase competitive advantage in a global market (Gunday, Ulusoy, Kilic, & Alpkan, 2011), organizations need to foster creativity since it is the first step to innovation (Zhou & Hoever, 2014). Due to the demands in a global economy to produce new products and experiences, more research on how to foster creativity in different work teams is critical to explore.

Divergent thinking as a measure of creative potential. Creativity is often assessed through divergent-thinking techniques, yet divergent thinking may not fully encompass what is creative (Runco & Acar, 2012). Runco and Acar further discussed that although divergent-thinking is helpful to estimate *creative potential*, but is not necessarily an indicator of real-world creativity. Divergent thinking is a useful way to help researchers understand the creativity construct and the potential that teams may have in different types of constraints to produce creativity outside of the laboratory.

Divergent-thinking is a cognitive approach of creativity; this approach is often used to understand creative thinking because it considers both the person and the process (Kozbelt, Beghetto & Runco, 2010). These tasks tend to explore associations and are often measured through divergent and convergent thinking (Kozbelt et al., 2010; Kanemastu & Barry, 2016). Convergent thinking considers a correct or practical answer (Kozbelt et al., 2010), while divergent thinking is a thought process that revolves around coming up with ideas, rather than exact answers (Paulus, 2000; Kozbelt et al., 2010). These associations are links of information by retrieval, relating and combining of information, converting these into new categories and forms, and transferring these from different domains of knowledge. Moreover, divergent thinking consists of four components that tackle associations: (1) fluency: generating a large amount of ideas, (2) flexibility: generating a wide variety of ideas, (3) originality: generating unique ideas, and (4) elaboration: building off of other ideas (Paulus, 2000).

As aforementioned, many researchers have, and continue to use, divergent thinking tasks to assess creativity (Runco, 2017). Oftentimes, divergent thinking tasks can be thought of as prompts that

elicit *idea generation* (Silva et al., 2008) to understand creative potential. One example of a divergent thinking task is unusual/alternate uses (Guilford, 1950) - these tasks ask a participant(s) how else they can use a brick (e.g., use it as a table, use it as a bed for my niece's doll). Although many researchers have used divergent thinking as an indicator of creativity, there have also been numerous articles pinpointing its deficiencies (e.g., Runco & Acar, 2012; Runco & Chand, 1995; Runco, 2017). Notably, Simonton (2003) suggested that divergent thinking tasks have low internal consistency and rarely result in large effects (as cited by Silvia et al., 2008).

It is possible to remedy some of these issues with divergent thinking by using subjective rating techniques, in particular the consensual agreement technique (Silvia et al., 2008). Amabile (1983) and other researchers have noted that people tend to agree on what is or is not creative without a guiding definition of creativity (see also: Runco & Jaeger, 2012); in other words, people know what is creative when they see it (Plucker & Makel, 2010). Although a definition may not be imperative, the boundaries of creativity still remain within the novelty-usefulness conceptualization; this means that individuals are able to denote the quality of an idea, and to what degree the idea is creative (Amabile, 1983).

Oftentimes, those who most accurately decide what is enhancing the market within the realm of originality and usefulness are domain-relevant experts in the field. For example, Marcel Duchamp's "Fountain" piece was not accepted by art experts or enthusiasts when the piece was created in the early 20th century (Mundy, 2015). To further this idea, in the field of industrial design (designing products) know what is both original and useful in their field of work; however, a computer scientist would not be able to accurately measure these components of creativity; that is they cannot assess whether a new design of a product is either original or useful. These examples demonstrate how experts are an influential aspect to what is deemed as creative. Additionally, within a single time period, researchers have found that consensual agreement, or the notion that experts in a given field are able to rate what is or is not creative even without a definition, exists (Baer, Kaufman, & Gentile, 2004; Kaufman, Baer, & Gentile, 2005).

However, creativity may not only be bound to experts in the field but the time period in which creativity is assessed. For example, in the 1950s and 1960s, Marcel Duchcamp's "The Fountain" was replicated and put in exhibitions - a replica even became one of the top influential artworks in the 20th century (Mundy, 2015). This particular example demonstrates that although experts are influential in defining what is creative, time period differentiation of creative ideas and thinking is also important. Moreover, experts may not provide the best information, and may, in fact, be unaccepting of original ideas.

Although true expert ratings are invaluable, it may not be imperative to utilize "experts" to get a valid and accurate measure of creativity. Some researchers question the validity and practicality of using expert ratings (Runco & Chand, 1994). In particular, these researchers have reasoned that expert judges can be inconsistent and may not be able to decipher true creativity. Silvia, Martin, and Nusbaum (2009) suggest that training individuals is sufficient to contrive accurate creativity ratings.

Even though disagreement lies within subjective ratings regarding experts, subjective techniques have been shown to provide more reliable and valid information based on the novel-usefulness definition. For example, Silvia et al. (2008) and Silvia (2011) demonstrated that subjective scoring methods performed better than objective methods (i.e., 0 = responses occurred multiple times; 1 = response occurred once) for novelty of ideas. These researchers found higher correlations between originality and number of ideas using the objective method compared to the subjective methods used insinuating the two dimensions are interrelated rather than separate components of creativity. Moreover, sample size may pose issues for objective scoring methods. For example, if there is an unusual uses task for a mug, someone might say "put liquid in it," and if no one else had given that response, it would be counted as "original;" therefore, an idea that is not original is being counted as creative, which is counterproductive to the novel-usefulness definition.

Two subjective measuring systems were discussed in Silvia et al. (2008) and Silvia (2011) – the "average scoring" method (rated all ideas produced) and "top 2" method (participant's chose their two

best ideas to be rated). These procedures demonstrated more reliability and decreased the adverse effects of the fluency and originality confound and small sample size (Silvia et al., 2008). Essentially, subjective methodology was able to capture more original thought, as well as thoughts that were not bizarre or irrelevant. Therefore, if using divergent tasks to assess creative output, subjective scoring will provide more valuable and accurate information compared to objective methodology.

Teams

Teams can be particularly useful for creative endeavors (Amabile, 1983; Amabile & Khaire, 2008). In particular, teams can be advantageous to get input from diverse backgrounds such as race, culture, knowledge domains, and skill variety (Paulus, 2000; Zhou, Verdenburgh, & Rogoff, 2015) through collaboration.

In general, a team can be described as a number of individuals who are committed to a common goal (Ale Ebrahim, Ahmed & Taha, 2009; Michan & Rodger, 2000; Paulus, 2000). Traditional teams (face to face) have been utilized by industrial organizations since at least the 1960's (Kirkman et al., 2002), but with the advances in technology over the past forty years, teams are going virtual. In 2012, the Society for Human Resource Management found that about half (46%) of companies used virtual teams. Globalization and technological innovations have shifted to full-time virtual teams. For example, in 2016, an article from flexjobs listed 125 companies that were mostly, if not all, remote based (Weiler Reynolds, 2016).

Furthermore, virtual work teams can be particularly advantageous to select maximally performing candidates regardless of geographic location (Kirkman et al., 2002), cut organizational travel budgets (Krumm et al., 2016), reduce overhead and relocation costs (Dulebohn & Hoch, 2017), provide more flextime for employees (Bell & Kozlowski, 2002), and obtain continuous productivity through utilization of different time zones (Dulebohn & Hoch, 2017).

Although research on teams have led to discoveries in the structure of teams, team composition, team processes (Mathieu, Hollenbeck, Van Knippenberg, & Ilgen, 2017), less research has targeted

differences between face-to-face teams and virtual teams on their creative output. To increase team creative output, it is imperative to understand the different processes between team types to capitalize on their output and potential for innovation.

Face-to-face team definition. Face-to-face teams are located in the same building, have synchronous communication, and have ease of coordination of tasks (Ale Ebrahim, Ahmed & Taha, 2009). Additionally, Pawar and Sharifi (1997) described traditional teams as being heterogeneous in educational and cultural backgrounds, able to monitor activities, and able to share information and resources at ease (Bergiel, Bergiel & Balsmeier, 2008) - whether it be work or non-work related (as cited in Ale Ebrahim et al., 2009). The present research, a face-to-face team will be one that works in the same location, does not use technology, and shares resources.

Virtual team definition. Not surprisingly, virtual teams look different from face to face teams. For example, Krumm et al. (2016) differentiated virtual teams from face-to-face teams by stating that virtual teams are typically dispersed globally and use digital media to communicate in contrast to face to face teams who meet in the same location. In congruence with Krumm et al. (2016), almost two decades of research have defined virtual teams as members being geographically dispersed (DeSanctis & Monge, 1998; Hertel, Geister & Kondradt, 2005; Peñarroja, Orengo & Zornoza, 2017) and use technology to communicate (Jarvenpaa, Knoll & Leidner, 1998; Ale Elbrahim et al., 2009). Many other researchers have suggested that another key ingredient to be a virtual team is having task interdependence (Dulebohn & Hoch, 2017; Hart, 2016). For this paper, a virtual team will be described as a collection of people that are dispersed geographically, who are interdependent and communicate using technology (i.e., computers, emails, video conferencing).

The creative process of teams. The creative process in teams is thought to involve various cognitive processes (Runco & Chand, 1995; Stempfle & Badke-Schaub, 2002; Ward, Smith, & Finke, 1999; Zheng et al., 2011). These processes generally focus on problem analysis, ideation, evaluation, and implementation (Runco & Chand, 1995; Zheng et al., 2011). Briefly, Zheng et al. (2011) discussed that

problem analysis is concerned with what the problem is and attempting to gain full understanding of said problem; in this step, a team is redefining a problem-space. Ideation allows teams to generate and explore many alternative solutions to the problem-space, while evaluation is utilized to analyze, refine, and select ideas (Zheng et al., 2011). Implementation, the final stage, is simply the execution of the selected ideas. This research primarily focuses on the ideation and evaluation phases, although some problem-analysis will be integrated – there is no focus on implementation, or as aforementioned, the "innovation" phase.

Differences in team processes. The creative process of all teams may be generally similar; however, differences regarding virtual and face to face team creative processes have not been thoroughly researched. For example, although both types of teams may have an ideation component in their process, the actual ideation process may need to be different.

Some process characteristics, such as communication, coordination, and social distance, can pose more issues in virtual teams (Dulebohn & Hoch, 2017). Communication is one of the most necessary processes to effective collaboration, and although communication exists within all types of teams (Michan & Rodger, 2000), there are still apparent discrepancies that may affect creative ideation and evaluation. Team communication has been shown to have a positive effect on creativity (Marlow et al., 2018), so it should be seen as an important contributor to team creative output. However, there are obvious differences between the communication style of traditional and virtual teams that one can ascertain from their definitions.

In general, team communication has been found to affect quality (de Guinea, Webster, & Staples, 2005) and productivity (Straus & McGrath, 1994) of outputs. Firstly, virtual teams may only have access to software that allows for teleconferencing, which reduces the amount of non-verbal information. The lack of non-verbal communication a virtual team possesses (Mickhan & Rodger, 2000; Walther, Loh, & Granka, 2005) may decrease the amount of visual exchange of information in virtual teams, and deny important information (Walther & Parks, 2002). Virtual teams struggle more with processes compared to face-to-face teams (de Guinea, Webster, & Staples, 2005). In particular, virtual teams may produce less

ideas than face-to-face teams (Straus & McGrath, 1994), which could be due to virtual team members having a harder time expressing their own thoughts, and interpreting other's thoughts (Lira et al., 2008; Straus & McGrath, 1994) compared to face-to-face teams, who are able to share more information (Andres, 2006; O'Neill et. al, 2016). Increased information sharing in face-to-face teams may be a result of many factors. Proximity of team members, for example, enables face-to-face teams to cultivate personal relationships, increase their general communication (Leenders et al., 2003), and enhance the flow of conversation (Rice, Davidson, Dannenhoffer, & Gay, 2007). Compared to virtual teams, face-to-face teams have also been found to be more effective and satisfied (Baltes et al., 2002) as well as be more efficient in decision making tasks (O'Neill et al., 2016).

Face-to-face teams may seem to be more advantageous in productivity, effectiveness, and decision making for creativity tasks. Ocker (2005) demonstrated that the lack of shared understanding in virtual teams inhibited their creative output. Increasing the shared understanding may be beneficial for virtual team creativity. Nemiro (2007) suggested that virtual teams ought to have more norms and protocols to be effective. Furthermore, it has been demonstrated that imposing norms and rules positively increases communication (Guo, D'Ambra, Turner, & Zhang, 2009), and enhances effectiveness in virtual teams (Rice, Davidson, Dannenhoffer, & Gay, 2007). Lastly, Mathieu, Heffner, Goodwin, Salas, and Cannon-Bowers (2000) noted that teams who organize information about the procedures and task strategies the team is dealing with benefit from understanding when and how a task will be accomplished. Task structure allows this type of process information for teams, which may decrease ambiguity. When a task is no longer ambiguous, communication and coordination may increase, allowing for more creative collaboration.

This type of thinking has gained little attention in the virtual team literature (Dulebohn & Hoch, 2017). Yet virtual teams, with task structure, could provide many benefits to organizations. Due to the general lack of research of creativity in virtual teams (Gilson, Maynard, Jones Young, Vartianinen, & Hakonen, 2015; Ocker, 2005), the present research intends to gain knowledge about not only about how

task structure may benefit virtual teams, but how virtual and face-to-face teams differ in the general creative output. It is with reasonable conviction that face-to-face teams will produce more creativity compared to virtual teams as previous researchers have suggested (Leenders, van Englen, & Kratzer, 2003).

Hypothesis 1a: Face to face teams will produce more novel ideas on idea generation tasks compared to virtual teams.

Hypothesis 1b: Face to face teams will produce more useful ideas on idea generation tasks compared to virtual teams.

Hypothesis 1c: Face to face teams will produce more average novel and useful ideas on idea generation tasks compared to virtual teams.

Goal Setting Theory and Task Structure

Creating a task structure may benefit teams – particularly virtual teams – on their creativity by increasing communication effectiveness and coordination of tasks. Task structure refers to the degree of rules and procedures in creative team process planning and the concept of task structure is similar to formalization or standardization of tasks (Im, Montoya, & Workman, 2013). Task structure can come about with decomposing a whole task into subtasks (Dennis et al., 1996; Dennis, 1999; Kratzer, Leenders, Van Engelen, 2007), or providing a specific procedure, a set of particular assignments, or sequential goals for teams to accomplish. Assigning a task structure may impact team communication and clarity of tasks and roles to provide a more efficient process to increase creative output.

Goal setting theory can be applied to further understand the importance of task structure. Locke and Latham (2002) proposed that goal setting is determined by conscious goals to advance a cause for action. Task structure helps determine and carry out goals through a procedure; this procedure can be assigned by someone else, or developed by group members; however, some research has illustrated that performance does not differ if the tasks are assigned or not (Locke & Latham, 1994). Other research has found that assigning goals may actually be beneficial to increase productivity (Locke & Latham, 1984)

and alleviate individual differences on preference of learning or goal orientation effects (Locke & Latham, 2006). Goals have several advantages for team structures. When teams have assigned goals, it may increase the amount of task-relevant information, shared mental models, as well as coordination and communication (Locke & Latham, 2006) in fostering creative output and increasing sharing. In other words, assigning goals is like assigning task structure in which set goals are followed like a procedure to increase team member clarity. Furthermore, assigning a task structure emulates goal setting theory, in which teams must procedurally follow goals to increase creative output.

To demonstrate how task structure may be more beneficial than no structure in team settings, goal setting theory may provide practical insights. For example, Shalley (1995) illustrated that setting any goal (i.e., saying "do your best") produces significantly better mean creativity than having no goal. Moreover, Latham and Baldes (1975) demonstrated that a more specific goal can enhance performance rather than having a vague "do your best" goal. Essentially, when goals are present in work tasks, individuals tend to work harder, especially when the goals are specific and difficult (Mitchell, 1982).

Combining the ideas of moderate structure, virtual teams and creativity, Dennis et al. (1996) tested a form of structure for virtual teams for a brainstorming task. In this study, there were two structure differences where one condition had 45 minutes for the task, whereas the other condition was decomposed into 3 separate tasks with 15 minutes each. Creativity was assessed via uniqueness and quality separately. It was demonstrated that the team with separated tasks produced higher mean of unique ideas and the sum quality of ideas. Additionally, it was found that good ideas (the quality of ideas that are 3 or higher on a 5-point scale) were also significantly higher for the decomposed group. To generalize their study, they conducted a field experiment in a similar fashion. This study demonstrated decomposed groups had a higher unique mean, quality sum, and more good ideas. Another study by Dennis and Valacich (1999) was similar in fashion and also displayed comparable results. Duimering, Ran, Derbensteva and Poile (2006), also posited that chaos can be reduced by decomposing tasks to help manage it, as well as provide better communication (i.e., quality of information) and coordination (i.e.,

resource management, quality of cooperation). Duimering et al.'s qualitative study suggested that when ambiguity is high, specific goals and decomposition should be imposed. These studies suggest that decomposing tasks may actually be beneficial for teams brainstorming creative ideas. Having a structure that already separates a question into multiple components, or a process, has the ability to be helpful in virtual teams and promote smoother communication.

Dovetailing with task structure, goal setting research provides insight on how more specific tasks can be more beneficial than having complete freedom. In other words, assigning a procedure that decomposes the overall creative goal into sub-goals may generate more creative output than assigning a procedure where the only goal is simply creative output. In summation, assigning specific tasks would be more advantageous to increase communication and shared mental models in teams compared to having one overarching and non-specific task.

Situational Strength Theory and Team Creativity

Setting goals can create strong situations (Locke & Latham, 2006). Strong situations refer to situations that have developed norms and rules, and behaviors are less variable among individuals (Meyer & Dalal, 2009; Meyer, Dalal, & Herminda, 2010). For example, at work, incumbents are expected to do tasks in a reasonable time, show up to meetings, and not be absent from work for no reason – this is a strong situation because employees are acting in a similar fashion. Outside of work, these individuals may vary more in their personalities such that some may procrastinate on household chores while others do not – being at home can be considered as a weak situation and as such, individual personality will have a stronger impact. In other words, traits shine through and behaviors vary when situations are more ambiguous and unstructured (Meyer et al., 2010), which is why many creativity researchers believe task structure will actually reduce creativity. To illustrate the notion of situational strength and task structure, Nouri et al. (2013) defined high situational strength as the degree of task clarity and specificity of performance. These researchers found that in computer mediated dyads, higher task specificity was negatively related to originality (r = -.47). Moreover, creativity in dyads was lower in high task specificity

compared to low task specificity. Due to prior research (Nouri et al., 2013), strong situations may inhibit creative processes and output, which is detrimental to organization's chances at innovation.

Weak Situations and Creativity

Many academics suggest that creative outcomes need freedom and autonomy (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Choi, Anderson & Veillette, 2009; Leenders et al., 2003). These researchers suggest that autonomy and freedom increase motivation, and structuring creativity tasks will impact creativity negatively due to the constraints by rules and procedures. Moreover, Gilson et al., (2005) posited that there is an imbalance between creativity and standardization because the goal of creativity is to "enhance variance" of possibilities (to create rather than maintain something), whereas the goal of structure is to "minimize variance" of possibilities (because everyone should be doing it the same way). Furthermore, goal specificity may reduce variation in performance (Locke, Chah, Harrison, & Lustgarten, 1989), creating a strong situation. Additionally, Vafeas and Hughes (2016) found that freedom and autonomy were highly desired and individuals were less motivated when they felt their creativity was not utilized due to rules and procedures. This implies that teams who experience structure produce less creativity because there is less flexibility and control over how the creative process is communicated and executed.

In another study, standardization was measured with a 3-item questionnaire that focused on strictness (Choi et al., 2009). This conceptualization of task structure failed to find significant correlations with individual's peer rated creativity (team member ratings) as well as task standardization and a measure of creative ability. However, an interaction of standardization and creative ability was found such that those with high creative ability thrived with low standardized process, and those with low creativity ability only did slightly better with high standardization. Based on the findings of Choi et al., it is argued that standardization may have a negative influence on *individual* creative performance.

Additionally, Gilson et al. (2005) found an interaction between creativity and standardization showing that those who reported their team members as highly creative, performed better under low

standardization conditions, while those who reported their team members as having little creativity benefitted from high standardization on an archival measure of performance. Although the outcome of this study did not specifically measure creativity as a criterion, it does correspond to Choi et al.'s (2009) study suggesting that standardization and creativity interact and affect performance outcomes.

The previously discussed research suggests that low standardization in individuals or teams produced the best performance outcomes. One limitation of these studies is that the structure imposed on that task were rated on scales and did not directly assess how moderate structure may impact team creativity. It may be plausible that a moderate amount of structure or standardization imposed on a team may lead to differential performance outcomes compared to high or low structure. Investigating moderate structure could pose new insights on the interaction between task structure and type of team on creative performance.

Ambiguity and Task Structure

Implementing a moderate structure for teams to use may be particularly beneficial (recall goal setting theory) to decrease ambiguity and increase mental models. For example, students are often told to create an outline of their paper to provide a foundation to their content. However, within that outline they are free to vary on the exact words they choose. Even some of the highest grossing creative writers use outlines to understand their procedure, such as J.K. Rowling (Rowling, 2018), Dan Brown (Brown, n.d.), and James Patterson (Patterson, n.d.), but still have the opportunity to put a truly novel story in between the points. For example, Rick Riordian stated that writer's block happens due to not having a plan and that one should "Outline where each chapter will go. It doesn't have to be very detailed, and you can always deviate, but if you plan ahead, you can minimize the time you spend starring at a blank screen" (Riordian, n.d.). This does not indicate they are uncreative with their writing, it simply suggests that having some structure can be extremely beneficial to understand and communicate ideas. If an individual function benefits from structure, there is no doubt that implementing a structure for teams can help them achieve high creative output. In other words, since there are multiple members in teams, providing a

structure can get team members on the same page (i.e., same mental model) and provide a narrative to attain their creative output successfully.

Research furthers this conceptualization. Wang et al. (2011) suggested that too little ambiguity could cause feelings of constraints and diminished motivation and found that role ambiguity significantly predicted creativity with an inverted U relationship; suggesting that a moderate amount of ambiguity would produce the best creativity. Furthermore, role ambiguity has been found to have an inverted U relationship with performance dependent on support for innovation (Leung, Huang, Su, & Lu, 2011). A meta-analysis conducted by Byron, Khazanchi and Nazarian (2010) found that role stressors (e.g., role ambiguity) had a curvilinear effect on creativity. As one can see, too much ambiguity *or* too much clarity can really dampen creative performance. To increase novel and useful ideas in teams, a moderate structure seems to be the most beneficial.

Creativity and Moderate Task Structure

Although creativity and structure appears to be an oxymoron, structuring a task can provide many benefits, such as setting goals and providing team norms, to increase communication and coordination efforts among team members. Although creativity theorists have suggested high task structure may decrease creativity, providing structure may enhance communication and coordination, which in turn, may increase creativity among teams. It seems like team creativity is a double-edged sword – is there a way that the team creative process is neither chaotic nor overly constricting?

Teams that are designed to provide creative output may need to utilize the benefits of both no structure and high structure. More succinctly, it may be more practical to impose a moderately structured approach – having structure should reduce role ambiguity and increase coordination and understanding of team goals, so there is more ease of communication and coordination, but still allow some freedom and control by having structure that is not so stringent.

Activation theory furthers this notion. In activation theory, it is posited that under very low or high stimulation, performance will not be maximal (Gardner, 1986). Rather, performance will be its best

under moderate levels of stimulation (Gardner, 1986). Gardner (1986) discerned that a non-stimulating task is one that is repetitive and does not use multiple cognitive processes, whereas, a stimulating task is the opposite. To further illustrate these differences, in Gardner's (1986) experiment, a non-stimulating task consisted of a matching task where participants had to partake in a matching exercise, whereas a stimulating task consisted of participants responding to 15 letters about a job in accordance to date and importance. The latter task requires more information processing and cognitive resources than the former, which could go on "autopilot." A team cannot go on "autopilot" when creating, developing, and deciding what ideas are the most novel and useful – they must use cognitive processes and resources[1].

Therefore, when teams have too much freedom, stimulation is too high and result in chaos – team members may not understand their tasks, their roles, or the processes on how to complete the overarching goal: creative output. Under strict rules, procedures, and norms, teams may be restricted, and too little stimulation may occur. In this scenario, the set processes lessen associative processes of creativity, meaning that novel and useful ideas are more difficult to develop; if ideas are more difficult to develop, motivation may decrease, and creative output will be low. However, providing a moderate structure should stimulate team members to the point of highest creative output – they have understanding between members that reduce the ambiguities of their tasks and roles, allowing optimal communication and coordination, while at the same time allowing freedom in processes to increase associations. To reiterate, moderate structure provides the best arrangement of freedom and constraints to optimize team creative output.

[1] Creativity tasks should be seen as complex due to making association between concepts, determining if an idea is novel, if it is useful, and then deciding what ideas are more novel and useful in comparison to others. Creativity, even in its simplest form, is something that requires cognitive effort and resources. The addition of a team makes creativity tasks more complex and stimulating because all of these individual processes are happening within individuals and then need to happen within the team.

Zhang and Bartol (2010) furthered the notion that there should be a balance between freedom and constraints in team creative processes. These researchers used activation theory to reason that moderate creative process engagement (time and effort spent on creativity in the workplace) is a better predictor of overall job performance than low or high creative process engagement. They found that creative processes engagement and overall job performance had an inverted-U relationship, signaling that moderate engagement toward creative processes actually create the best overall job performance. Although not directly related, Zhang and Bartol's research provides important implications for team creative output regarding process characteristics.

Examples in everyday life demonstrate how moderate structure can produce creativity. Take baking (or cooking) for example – if a baker is told to make the most creative dessert they can, they will not drop the foundational components they learned in culinary school (baking soda vs. baking powder) - otherwise it would be chaotic and useless. If they follow an exact recipe, they do not have the option to deviate and truly be novel. In other words, they need to combine the two for an optimal solution that is both useful and novel. Additionally, baking competitions often give some rules, instructions, and goals but also allow for creative freedom. Ambiguity research has shown positive effects for the questions this author posits; namely that moderate amounts of structure should benefit team creativity more than a highly chaotic or a highly constrained structure.

Much like the baking example, the benefit of a moderate structure opposed to a highly structured task have been shown by Abric (1971) when considering divergent thinking creativity tasks. Abric held the position that an open-structure (some constraints), rather than a closed-structure (many constraints), would emulate more divergent and creative thinking. This notion was supported, making it plausible, that in team settings, having some constraints can elicit more creative thought and more acceptance of other team members rather than a high structured approach.

The Present Research

The present research will provide new insights by examining the impact between no structure and moderate structure as well as face-to-face teams and virtual teams and creative output. It is with reasonable understanding that virtual teams will benefit more than face-to-face teams with an imposed moderate structure due to their differences in constraints (i.e., communication, coordination, and ambiguity). Virtual teams should have a larger difference between novel and useful ideas (creative output) from the no structure and moderate structure conditions compared to face-to-face teams.

Hypothesis 2a: Imposing moderate structure on idea generation tasks will produce more novel ideas generated by teams compared to imposing no structure on the idea generation tasks.

Hypothesis 2b: Imposing moderate structure on idea generation tasks will produce more useful ideas generated by teams compared to imposing no structure on the idea generation tasks.

Hypothesis 2c: Imposing moderate structure on idea generation tasks will produce more average novel and useful ideas generated by teams compared to imposing no structure on the idea generation tasks.

Hypothesis 3a: Task structure will moderate the relationship between team type and idea generation tasks, such that virtual teams will have a great benefit from moderate structure, whereas face-to-face teams will have a slight benefit from moderate task structure regarding novelty of ideas.

Hypothesis 3b: Task structure will moderate the relationship between team type and idea generation tasks, such that virtual teams will have a great benefit from moderate structure, whereas face-to-face teams will have a slight benefit from moderate task structure regarding usefulness of ideas.

Hypothesis 3c: Task structure will moderate the relationship between team type and idea generation tasks, such that virtual teams will have a great benefit from moderate structure, whereas face-to-face teams will have a slight benefit from moderate task structure regarding averaged novelty and usefulness of ideas. Please See Figure 1 for a graph of hypotheses 3a, 3b, and 3c.

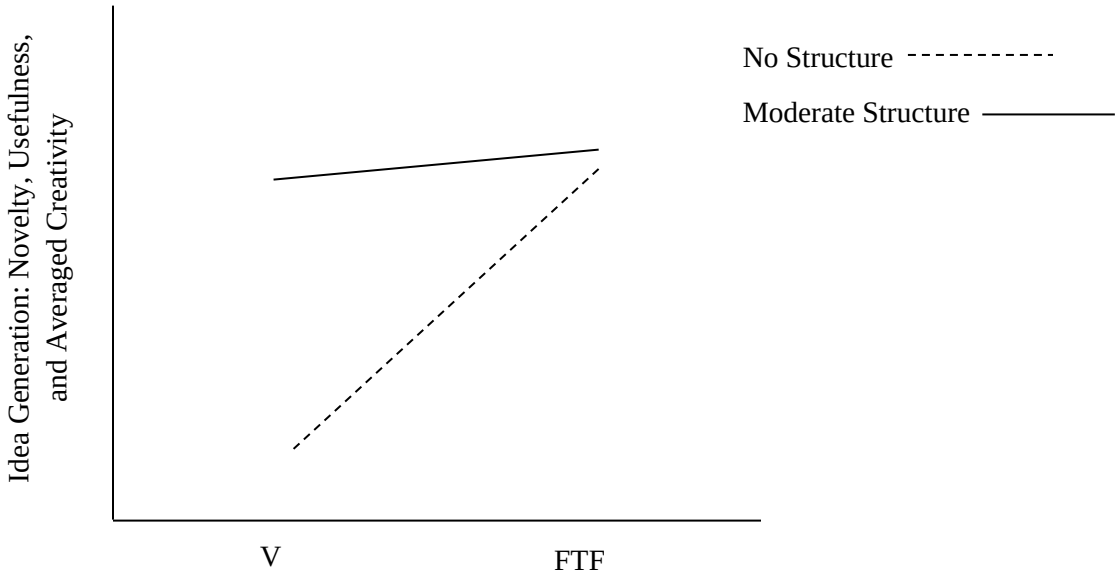

Figure 1. Hypotheses 3a, 3b, and 3c projected moderations.

Note: V = Virtual teams, FTF = face-to-face teams

Chapter II: Method

Structure Manipulation Pilot

To assess if task structure had a true manipulation as moderate, the definition of task structure and the task structure directions were given to a Midwestern University students (n = 2), who rated on a 5-point scale of how they viewed the structure of these tasks (1 = not constraining, 2 = minimal constraints, 3 = moderate constraints, 4 = many constraints, 5 = very constraining). They were also asked to provide reasoning behind their endorsement to better analyze the manipulation. These results showed that the manipulation of moderate structure was rated as between many constraints and very constraining (M = 4.50), while no structure was rated between minimal and moderate constraints (M = 2.50).

Study Time Pilot

The study was piloted to determine the amount of time teams would need to complete the present research. Teams of graduate students at a Midwestern University were asked to complete the pilot study; this pilot showed the alternate uses tasks were completed within 15 minutes, and the improvement task was completed within 25 minutes. After consultation with a University professor that had done research on creativity, times were reduced to 30 minutes for non-structured groups and 10 minutes per task for structured groups.

Participants

Participants in this study included 42 individuals (Male ≈ 10; Female ≈ 32) who were randomly assigned into teams of 3 (14 total teams) from a Midwestern University's Psychology department and received extra credit for their participation.

Materials

An informed consent was used to describe the purpose of the study and information regarding the researcher and her advisor. A packet containing one question about knowing others, one on creativity classes, and a questionnaire on personal need for structure (Thompson, 2002) was also utilized.

Additionally, each team member received a set of printed instructions based on their structure and team type to follow to complete their tasks; tasks were counterbalanced to alleviate any task order effects.

Measures

Team type. Team type was operationalized into two groups: face to face teams and virtual teams. Face to face teams consisted of 3 participants and were manipulated by putting all members in the same room where they could see and communicate with one another face to face at a table. Virtual teams also consisted of 3 participants and manipulated by theoretically being "geographically dispersed" and put into *separate* rooms. Virtual teams were only allowed to communicate via Google Hangouts, representing a teleconferencing situation.

Task structure. Task structure was separated into two groups referring to moderate task structure and no task structure. Moderate task structure will emulate goal theory and "moderate" situational strength. These instructions are intended to provide specific goals, but teams are allowed to vary on how to specifically process them. In other words, teams have the discretion to perform the goal as they see fit (i.e., decision making). Furthermore, moderate task structure was operationalized as five specific end goals for all tasks relating to the broad categorizations of Stempfle and Badke-Schaub's (2002) theory on cognition in design teams. These broader categorizations are denoted as (1) generation of ideas, (2) exploration of ideas, (3) comparison of alternative ideas, and (4) selection of ideas; these correspond to the general creative process' ideation and evaluation. More specifically, generation of ideas simply refers to proposals of ideas related to the task, exploration of ideas concerns dialogue between members where ideas can be interpreted, expanded, and/or modified; the objective in these two goals is to widen the amount of ideas generated and explored (Ward, Smith, & Finke, 1999). Comparison of ideas is intended to have teams critically compare their ideas and narrow them down to eventually select the ideas they would like to retain for evaluation (Campbell, 1960). Participants were further instructed that all team members must contribute to each step to emulate equality of contribution to tasks. A time constraint of 25

minutes per task was given for equal work on each task. At the end of each task, all teams were told to pick their top five ideas.

No task structure was conceived as weak situational strength; therefore, no constraints except for time were given. In other words, no task structure was operationalized as having no rules or specific directions. Teams were put in the same room and allotted 1 hour and 15 minutes to complete all three tasks. Please refer to Appendix A for the full set of instructions for both moderate and low task structure.

Knowing others. A single question asked each participant if one of their members was a friend or worked on a project with one another for over 2 weeks. The rating scale was a dichotomous 'yes' or 'no'. The purpose of this question was to control for those knowing or working with someone else in their team potentially enhancing communication and understanding between members.

Creativity classes. A single question asked for those who have taken a creativity or innovation class in high school, college, or another program. The rating scale was a dichotomous 'yes' or 'no'. The purpose of this question was to control for those knowing how to increase creativity or have extensively used or learned about divergent thinking techniques.

Personal need for structure. A 12-item questionnaire with a 6 point-Likert type rating scale of (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = slightly agree, 5 = moderately agree, and 6 = strongly agree) was used to assess personal need for structure by Thompson et al. (2001). The purpose of this scale is to provide information on how much an individual needs structure, where someone high with personal need for structure likes clarity and structure, whereas someone low prefers ambiguity (Thompson et al., 2001). Thompson et al. suggests that a person with high personal need for structure may be inhibited in creative environments where flexible thinking occurs. This variable is being used as a covariate to account for the amount of structure that a group prefers. Cronbach's alpha in Thompson et al.'s original study was .84. In this study, the Cronbach's alpha was .77.

Creativity. Creativity was assessed using three divergent thinking tasks; two alternate uses tasks with a brick and hanger and an improvement task that asks teams to make a toy truck more entertaining

for children. They were told to employ a "Top 5" method of choosing their most novel and useful ideas, much like Silvia et al. (2008) and Silvia (2011) "Top 2" method discussed. For an exploratory analysis, frequency of ideas was also assessed; this was simple the amount of ideas each team produced.

Creativity rating. A creativity rating form was given to three raters assessing novelty and utility of ideas generated on the team idea generation tasks, emulating the operational definition, that they were trained on (see Appendix C for training). Three creativity tasks were given: two unusual uses tasks and one "make it better" task. Groups were required to produce their top 5 most novel and useful ideas and report them. Novelty and usefulness were rated separately on two different scales. Amabile (1983) suggested that people tend to think of creativity on a continuum comparing what is more or less creative; therefore, a 7-point Likert-type scale was used to rate novelty, and a 7 point Likert-type scale was utilized to rate usefulness. The ICC's (2,3) for interrater agreement are provided: hanger novelty (.74), hanger usefulness (.66), brick novelty (.73), brick utility (.69), toy truck novelty (.83), and toy truck utility (.04). Utility scores fared the worst in interrater agreement, and did not meet the recommended cutoff of .70 suggested by Peterson (1994).

The three raters independently rated each group's top five items resulting in 15 ratings per rater for novelty (45 overall ratings) and 15 ratings per rater for usefulness (45 overall ratings) per group. The top 5 ideas for each task were averaged for novelty and usefulness separately per rater, per task, and were averaged together for an overall creativity rating for each task. Afterward, the researcher and her advisor did an informal content analysis for top 5 items that were similar in content for teams; both determined if ideas from different teams were similar or not (e.g., team 1 put "art project," and team 2 put "use for a piece of art," and any discrepancies were discussed until a consensus was reached; the ideas that were considered similar were put into a category. No idea was rated twice if it was determined as a similar idea (i.e., if two or more groups put the same idea down, the idea was only rated once and applied to every team who answered that question). Appendix D shows the top 3 most creative and useful ideas produced for each task as determined by the raters.

Design

This study was a 2 X 2 between-subjects factorial design. The criterion variable measured was creativity ratings and there were two independent variables: type of team and amount of structure. The type of team was dichotomized as traditional (team communicated face to face) or virtual (team members communicated through computer teleconferencing). Amount of structure was dichotomized as moderately structured task (were given 3 prompts with specific directions, order, and time limits, for how to carry out task) or no task structure (were given 3 prompts and were told they had one hour to finish and pick their top 5).

Procedure

Conditions were randomized and ordered on a "conditions sheet" before any sign-up lists were posted. Sign up lists recruited 4 participants, instead of 3, in case of any drop-out. Since teams could only have 3 participants, if the fourth showed up, they were given an option to come back another time, or participate in another study the researcher was conducting. Twenty-four hours before the study, if there were not enough participants to form a team, students were emailed to choose another time.

Virtual teams. If it was a virtual team condition, three computers in separate rooms were turned on and set up with a teleconfrerence system with preassigned accounts, and Google Docs was brought up on each member's computer. Additionally, the researcher ensured each room had the respective instructions sheet for team members to follow.

Face-to-face teams. If it was a face to face team condition, a larger room was utilized. Sheets of paper and writing utensils were given to each member of the face to face team. Only the directions for the specific condition (structured or unstructured) were taken out to give participants along with the informed consent, demographics, and other measures.

As students entered the room, they were given the informed consent and asked to read through and sign it. The proctor administered guided members to a room. Participants were then asked to fill out the personal need for structure questionnaire, creativity knowledge, and if they knew anyone in their

team. When all team members were done, the researcher used a protocol to run through the condition's respective instructions. Virtual teams were told they would only be allowed to communicate over an online teleconference system, while face-to-face teams were instructed to communicate verbally. The researcher also informed the participants that they would be letting them know when their time was near done.

In the moderate task structure conditions, the researcher told the participants were told there was 5 minutes remaining for each of the three tasks; in the no structure condition, the researcher told participants when there was, 15, and 5 minutes remaining from the entire 30 minutes allotted. For face-to-face teams, in adherence to the aforementioned times, the researcher would leave the room and let participants know when time was up for each task (moderate structure) and overall study (no structure). When the tasks completed, all team members were thanked for their time and given extra credit for their class.

Chapter III: Results

Descriptive Statistics and Correlations

Individual scores on knowing others were aggregated for each group, and creativity classes were also aggregated for each group. The Personal Need for Structure assessment was recorded as individual and aggregated scores for each group. Descriptive statistics are provided in Table 1 for all aggregated scores, and individual personal need for structure.

Novelty scores were averaged, first for each rater, then for each divergent thinking task – resulting in 3 novelty scores for each group. Utility was also averaged first for each rater, then each task – resulting in 3 utility scores for each group. Descriptive statistics regarding these scores are provided in Table 1. In total, teams produced between 6 and 22 ideas for the hanger task (M = 12.92), 6 and 25 ideas for the brick task (M = 14.21), and between 7 and 24 ideas for the toy task (M = 14.00).

Table 1

Means and Standard Deviations Among Key Study Variables

	n	*M*	*SD*	Skew	Kurtosis
Individual PNS	42	3.21	0.50	-0.02	0.72
Group PNS	14	3.18	0.36	-	-
Group Knowing Others	14	0.57	1.02	-	-
Group Creativity Classes	14	0.43	0.51	-	-
Hanger Novelty	14	3.70	0.86	0.19	-1.11
Hanger Utility	14	4.74	0.87	-1.17	0.75
Brick Novelty	14	3.20	0.89	0.68	0.33
Brick Utility	14	4.76	0.89	-1.09	0.34
Truck Novelty	14	3.32	0.83	0.53	-1.13
Truck Utility	14	4.78	0.37	-1.53	2.86
Alternate Uses Novelty	14	3.45	0.81	0.45	-0.38
Alternate Uses Utility	14	4.75	0.82	-0.97	-0.14
Total Novelty	14	3.41	0.73	.94	0.00
Total Utility	14	4.76	0.64	-1.10	0.14

Note. PNS = Personal Need for Structure; Utility = Usefulness Rating; Novelty = Novelty Rating

Correlations were run using the Pearson correlation coefficient on the aggregated group creativity classes, knowing others, personal need for structure, and all novelty and utility scores. Correlations are provided in Table 2.

Table 2

Correlations Among Key Study Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Classes	-								
2. Knowing	-.06	-							
3. PNS	-.23	.38	-						
4. Hanger Utility	-.33	-.10	.02	-					
5. Brick Utility	-.13	-.24	-.09	.74**	-				
6. Truck Utility	.13	-.47	-.14	.52	.72**	-			
7. Hanger Novelty	.37	.37	.03	-.80**	-.78**	-.55*	-		
8. Brick Novelty	.12	.19	.06	-.65*	-.94**	-.69**	.74**	-	
9. Truck Novelty	.28	.26	.14	-.46	-.74**	-.55*	.44	.56*	-

Notes. Classes = creativity classes, Knowing = knowing others in group, PNS = personal need for structure group score, Utility = Usefulness Rating; Novelty = Novelty Rating
**p < .05, **p < .01*

Inferential Tests

A 2 X 2 between-subjects multivariate analysis of variance (MANOVA) was performed on novelty and utility. The MANOVA tested whether novelty and utility are associated with team type and task structure, as well as their interaction.

Frequencies were run for each group, no structure and Ftf (n = 3), no structure and virtual (n = 4), moderate structure and Ftf (n = 3), and moderate structure and virtual (n = 4). The final sample was small and had a sample size of N = 14. Assumptions for MANOVA were tested for outliers, normality (Shapiro-Wilk's test), linearity, and homogeneity of variance. Assumptions for normality, linearity, and homogeneity of variances were violated for some of the tasks, while the assumption of no outliers were found to not be violated. The assumption of no multicollinearity between dependent variables was

violated – utility and novelty on all tasks were highly related to one another, albeit negatively. The assumption for equality of covariance matrices was tested using Box's test of equality of covariance matrices, which was not violated using the rule of $\alpha = .001$; although this result should be interpreted with caution due to normality being violated.

Although most assumptions were violated, use of the MANOVA continued to test hypotheses 1a, 1b, 2a, 2b, 3a, and 3b. Based on Wilk's lambda, combined novelty and utility for the hanger divergent thinking task were not affected by team type, $F(2, 9) = 1.12$, $p = .368$. Combined novelty and utility were not affected by task structure, $F(2,9) = 1.12$, $p = .368$. The two main effects were not significant. The interaction effect (team type x task structure) was also not significant, $F(2, 9) = 0.07$, $p = .937$. Therefore, team type and structure did not affect the combined novelty and utility ratings on the hanger divergent thinking task, and hypotheses Tests of between-subjects effects were also examined, and no significant results were reported.

Based on Wilk's lambda, combined novelty and utility for the brick divergent thinking task were not affected by team type, $F(2, 9) = 0.55$, $p = .594$. Combined novelty and utility were not affected by task structure, $F(2, 9) = 0.62$, $p = .558$. The two main effects were not significant. The interaction effect (team type x task structure) was not significant, $F(2, 9) = 0.50$, $p = .625$. Therefore, team type and structure did not affect the combined novelty and utility ratings on the brick divergent thinking task. Tests of between-subjects effects were also examined, and no significant results were reported.

Based on Wilk's lambda, combined novelty and utility for the toy truck divergent thinking task were not affected by team type, $F(2, 9) = 0.40$, $p = .682$. Combined novelty and utility were not affected by task structure, $F(2, 9) = 0.15$, $p = .861$. The two main effects were not significant. The interaction effect (team type x task structure) was not significant, $F(2, 9) = 3.47$, $p = .077$. Tests of between-subjects effects were examined, and there was a significant interaction for team type by structure for toy truck utility ratings, $F(1, 10) = 7.55$, $p = .021$. To ensure this was not a Type I error, a Roy-Bargmann stepdown analysis was used to further examine this relationship. The Roy-Bargmann analysis tested the effect the

interaction of team type and structure had on utility ratings after considering novelty ratings (used as a covariate). The adjusted means showed non-significant results $F(1,9) = 4.22$, $p = .070$, suggesting that the MANOVA Tests of between-subjects effects did commit a Type I error, and an interaction effect does not truly exist for toy truck utility ratings. Therefore, hypotheses 1a, 1b, 2a, and 2b were not supported for the any of the divergent thinking tasks.

To test hypotheses 1c, 2c, and 3c, utility and novelty ratings were averaged for each group. Based on Wilk's lambda, combined novelty and utility for the hanger divergent thinking task were not affected by team type $F(1,9) = 0.18$, $p = .891$, or task structure $F(1,9) = 0.06$, $p = .944$. The interaction between team type and task structure was also nonsignificant $F(1,9) = 2.35$, $p = .151$. Therefore, hypotheses 1c, 2c, and 3c were not supported for overall creativity.

Chapter IV: Discussion

Interpretations

The results suggested that neither team type nor structure contribute to differences in creativity. First, descriptive statistics produced little variability in dependent variables. Variability may have been reduced due to the "Top 5" method. In other words, having groups choose five ideas may have resulted in chosen ideas that were less creative; choosing less creative ideas may have penalized group's overall ratings due to a bad idea. Because the average of a highly creative idea with a highly uncreative idea would produce an average result; this could have resulted in the non-significant results found. The skewness and kurtosis of the ratings indicated a non-normal distribution. Although it would make sense for a slight skew, because highly creative ideas should theoretically be one in many, the distributions were positively skewed, which would be the expected result. This could have also been a result of the "Top 5" methodology.

Correlations between novelty and utility on all tasks were highly and negatively correlated. This suggests that as novelty increased, utility decreased. This may be due to the divergent thinking tasks, rather than solving a real-world problem. Although there should be some relationship between the two variables, it suggests that groups cannot have an idea that is both very novel and very useful (and vice versa), which is counterproductive to creativity's definition. The covariates, group PNS, creativity classes, and knowing others were not related to the dependent variables. The results may suggest that creativity training, knowing or not knowing others, and the overall need for structure for the group do not affect creative potential. In other words, the results indicate that creativity may not improve if individuals previously worked together, if anyone received training in creativity, or that group characteristics of preferred structure dampen/increase group creative potential. The inferential statistics results indicated that team type and task structure do not affect novelty ratings or usefulness/utility ratings.

Limitations and Future Research

There are several important limitations that should be addressed about the present study. First, because college students were used as participants rather than work teams; work teams may be affected by the team type and/or structure to for creativity. First, although students were prompted to not utilize the internet for the divergent thinking tasks, there is no evidence students had not researched the tasks because the study proctor was not in the room during the study. Next, college students may lack the motivation to produce novel and useful ideas. For example, students may have engaged in social loafing (i.e., when one or multiple individuals do not participate in a team task) (Rutte, 2003).

Other limitations to the present study was the absence of domain-specific knowledge and newly formed teams. Domain-specific knowledge, as such in a work environment, is a necessary component to creativity (Zeng, Proctor, & Salvendy, 2011), and the lack of real-world problems as well as domain-specific knowledge may have weakened the effect of team type, task structure, and their interaction. Additionally, the teams were newly formed, which may have impacted team functioning and the effects of task structure. Tuckman's (1965) model discerning the stages of team development suggests that before team's can perform, they go through several other stages that consider (1) orientating toward the team, (2) dealing with team conflict, and (3) developing norms (as cited in Tuckman & Jensen, 1977); teams in the present research may not have been able to successfully go through the three stages indicating a lack of performance in their ideas.

Moreover, Hackman (2012) theorized conditions teams ought to have to be successful. In his research, Hackman proposes that the team must be real, have a compelling purpose, have the right number and mix of individuals, have clear norms, have a supportive organization, and engage in team-focused coaching. As discussed, this these teams were fictitious and may not have been motivated through the purpose of the study. Additionally, norms may not have been thoroughly established. In essence, many conditions (i.e., mediators or moderators) were not accounted for in the present research and that may have resulted in a non-significant effect.

Although one goal of the moderate task structure was to provide role clarity– it may not have allowed team members to deal with conflict appropriately as research has demonstrated that a moderate amount of conflict in teams produce the most creative potential (Farh, Lee, & Farh, 2010), in the present research there may not have been *enough* conflict between team members to produce novel and useful ideas. Further research ought to be conducted on team tenure regarding creativity and utility while keeping team type and task structure in mind.

Secondly, the "expert raters" only had a one-hour training session on creativity. Baer, Kaufman, and Gentile (2004) stress the importance of well-seasoned experts, while Runco and Chand (1994; 1995) propose using expert ratings may not be an accurate approach. However, Silvia, Martin, and Nusbaum (2009) suggested training raters should suffice for rating creativity accurately. Due to the importance of experts, and the low interrater reliability coefficients of the utility ratings, it cannot be determined with certainty that team type and task structure would not have had an effect on brainstorming creative ideas, and/or the hour creativity training session may not have been rigorous enough.

The sample size of the groups was small. The small sample size may have resulted in a Type II error, as the suggested sample size for the present research from a power analysis was 158 groups (analysis based on a moderate effect size). Further research ought to be conducted with larger sample sizes to determine if effects truly exist. Most, if not all, assumptions for the inferential tests used were violated. This may indicate that other statistical procedures should have been utilized (e.g., nonparametric tests). Additionally, the manipulation of structure may not have been appropriate, as the two graduate students that rated no structure as "low-moderate structure" and moderate structure as "moderate-high" structure; if this was the true interpretation of structure, then the present study compared two types of moderate structure. Give the sample size, the pilot study may not have offered insightful information. Moreover, graduate students may not have been an appropriate sample to use for a pilot because their frame-of-reference of what is a highly constraining process may be different compared to the average

person. Additionally, a highly constraining structure was not provided to the pilot study participants, which may have altered their perceptions of task structure.

Lastly, although divergent thinking tasks are often used to assess creative potential or an indicator of creativity (Runco & Acar, 2012), the divergent thinking tasks used may not be the best assessment of real-world organizational problems that need creative problem-solving for an innovative process, product, or service (Runco & Acar, 2012). Divergent thinking tasks focus on novelty more than utility (Zeng, Proctor, & Salvendy, 2011), which may have been a reason for why utility interrater reliability was low. There were novel, but inappropriate ideas, as noted by the correlations between novelty and utility; divergent thinking tasks lack the ability to provide ideas that are appropriate (an inappropriate idea may be to jump on a trampoline and try not to get hit) which is another issue with divergent thinking tasks (Zeng, Proctor, & Salvendy, 2011). Moreover, Zeng, Proctor, and Salvendy (2011) discuss that divergent thinking tasks may not be useful to predict creative potential in the real-world and question its generalizability due to weak predictive validity coefficients. This design, along with divergent thinking tasks, may not have promoted team interdependency, a necessary component for teamwork. For example, teams may have had one individual complete one task, and not have worked as a team for all three tasks; in other words, each member may have individually contributed to only one of the three tasks, indicating no interdependency (i.e., teamwork). It is therefore with uncertainty that results from the present research can determine if team type, task structure, or their interaction can be generalized to organizational issues that need creative solutions. More research ought to be conducted on appropriate laboratory tests for creative potential that consider the creative process over time, rather than a one-time event.

Implications for Research and Practice

Creativity may not be a juxtaposition of team type and structure. Virtual teams and face to face teams may generally produce similar outputs in a one-time meeting of creativity. This implies that if an organization intends to form a new team to generate creative ideas in one sitting, the organization could choose a virtual team or face-to-face team. Moreover, moderate structure may not impact creativity in

teams, and having any amount of freedom produces similar results regarding creativity. This implies that organizations may not have to change their processes and/or spend more resources on putting different structure policies into place. Although, it is important to note, that this may not be true for highly constraining processes.

The above reasoning for why non-significant results were obtained is probably unlikely, as the limitations in the present research were abundant. The present study should be used as a starting point for understanding how team type and task structure impact creativity in teams. As aforementioned, future research ought to be conducted with larger sample sizes, expert raters or objective measures of creative performance (e.g., patents), for real-world problems, and in actual organizations. Further research should also be conducted on how these variables impact innovation, rather than just creative brainstorming. Furthermore, research should try to evaluate if team task structure, no structure, moderate structure, or strict structure, processes determine how innovation comes to fruition.

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Appendix A: Instruction Sheets for Study Conditions

Instructions Sheet for Moderate Structure Condition

Instructions: You will have 45 minutes to complete the following 3 tasks. After each task is completed, you will need to decide as a group to what your top 5 most creative and useful ideas are. All team members need to participate in the 5 goals and the goals must go in the order listed, but you may perform the 5 goals and make decision criteria based on your team's preferences, as well as deem the amount of time for each goal in the 25 minute allotment. The proctor will give you a 10 minute warning before your time is up.

Task 1.

Spend 25 minutes brainstorming ideas for the following prompt:

"What are alternate uses of a hanger?"

Goal 1 – Generation of Ideas: Come up with as many ideas as possible within your team.

Goal 2 – Screening of Ideas: Pick several ideas that your team believes are the most original and useful.

Goal 3 – Further Exploration: Elaborate on the ideas chosen in Goal 2 to make them more original and useful (i.e., check inconsistencies and try to improve ideas) to further develop your team's ideas.

Goal 4 – **Comparison of Ideas**: Compare and contrast your team's ideas from Goal 3 to determine what ideas are the most novel and useful.

Goal 5 – Final Selection: Choose the Top 5 best ideas from your team.

Task 2.

Your team is allotted 25 minutes for the following prompt:

"How can you improve this toy truck to make it more entertaining for kids?"

**Choose a member write down the ideas on your Google Docs sheet.

Goal 1 – Generation of Ideas: Come up with as many ideas as possible within your team.

Goal 2 – Screening of Ideas: Pick several ideas that your team believes are the most original and useful.

Goal 3 – Further Exploration: Elaborate on the ideas chosen in Goal 2 to make them more original and useful (i.e., check inconsistencies and try to improve ideas) to further develop your team's ideas.

Goal 4 – **Comparison of Ideas**: Compare and contrast your team's ideas from Goal 3 to determine what ideas are the most novel and useful.

Goal 5 – Final Selection: Choose the Top 5 best ideas from your team.

Task 3.

Your team is allotted 25 minutes for the following prompt:

"What are the alternate uses of a brick?"

**Choose a member write down the ideas on your Google Docs sheet.

Goal 1 – Generation of Ideas: Come up with as many ideas as possible within your team.

Goal 2 – Screening of Ideas: Pick several ideas that your team believes are the most original and useful.

Goal 3 – Further Exploration: Elaborate on the ideas chosen in Goal 2 to make them more original and useful (i.e., check inconsistencies and try to improve ideas) to further develop your team's ideas.

Goal 4 – **Comparison of Ideas**: Compare and contrast your team's ideas from Goal 3 to determine what ideas are the most novel and useful.

Goal 5 – Final Selection: Choose the Top 5 best ideas from your team.

Instructions Sheet for Non-Structured Condition

Instructions: You will have 1 hour and 15 minutes to complete the following 3 tasks. After each task is completed, you will need to decide as a group (majority rules) to what your top 3 most creative and feasible ideas are. The researcher will inform you when there is 30, 15, and 5 minutes remaining. You can complete the tasks in any order.

1. What are the alternate uses of a hanger?
2. How can you improve this toy truck to make it more entertaining for kids?
3. What are the alternate uses of a brick?

Appendix B: Creativity Rating Scales

Quality Rating Scale

Quality

Answers to the problem should be rated on a seven-point scale based on the following criteria:

Usefulness: Is the idea feasible, useful, or practical?

1 = Extremely Un-Useful

7 = Extremely Useful

1 2 3 4 5 6 7

Novelty Rating Scale

Novelty

Answers to the problem should be rated on a seven-point scale based on the following criteria:

Novelty: Is the idea unique, original, different, or imaginative?

1 = Extremely Traditional Use

7 = Extremely Novel Use

1 2 3 4 5 6 7

Appendix C: Rater Training

Amabile (1983) stated that one must need a reliable subjective judgement to capture creativity, and Silvia et. al (2008) suggested that researchers use training methodology when using subjective ratings. Before studies began, a frame-of-reference (FOR) training was given to three raters in the I-O Psychology Master's program; FOR training has been shown to increase rater accuracy (Aguinis, 2009; Roch, Woehr, Mishra, & Kieszcynska, 2012; Woehr & Huffcut, 1994). The ultimate goal of the FOR training was to familiarize raters with creativity, divergent thinking, and the rating scales.

Based off suggestions by Benedek, Muhlmann, Jauk, and Neubauer (2013), the FOR consisted of (1) the rater's definitions of creativity, (2) the definition of creativity used in the present research (novelty and usefulness, (3) discussion of divergent thinking, (4) subjective versus objective scoring methodology, and why subjective scoring is utilized, (5) presentation of the current rating scales, (6) two practice ratings, (7) a final question and answer session, and (8) a minimum qualifications test to proceed as raters. The minimum qualifications evaluation consisted of 6 questions pertaining to the training at the end of the session to determine if it was effective, and all answers needed to be correct to move on as a rater. After studies began, raters were required to complete the evaluation one more time right before their first rating session. Once the evaluation was complete with all answers correct, the same 3 raters were asked to rate the divergent thinking tasks on their novelty and usefulness when data became available.

Rater Training Practice Items

Practice Question 1: Alternate Uses Task – *Alternate Uses of a Brick*

Novelty Rating Scale

<u>Novelty</u>

Answers to the problem should be rated on a seven point scale based on the following criteria:

Novelty: Is the idea unique, original, different, or imaginative?

1 = Extremely Traditional Use

7 = Extremely Novel Use

Create a Candle Holder

1 2 3 4 5 6 7

Use it as a paperweight

1 2 3 4 5 6 7

Use it as a doorstop

1 2 3 4 5 6 7

Use it to break a window

1 2 3 4 5 6 7

Smash bugs

1 2 3 4 5 6 7

Quality Rating Scale

Quality

Answers to the problem should be rated on a seven point scale based on the following criteria:

Usefulness: Is the idea feasible, useful, or practical?

1 = Extremely Un-Useful

7 = Extremely Useful

Create a Candle Holder

1	2	3	4	5	6	7

Use it as a paperweight

1	2	3	4	5	6	7

Use it as a doorstop

1	2	3	4	5	6	7

Use it to break a window

1	2	3	4	5	6	7

Smash bugs

1	2	3	4	5	6	7

Practice Question Two: Improvement Task: *Improve this Chair to be More Comfortable*

Novelty Rating Scale

Novelty

Answers to the problem should be rated on a seven point scale based on the following criteria:

Novelty: Is the idea unique, original, different, or imaginative?

1 = Extremely Traditional Use

7 = Extremely Novel Use

Padded Armrests

1 2 3 4 5 6 7

Built in Speakers

1 2 3 4 5 6 7

Head and Neck Rest

1 2 3 4 5 6 7

Create a bubble like shield that can be turned on to ensure a quiet work environment

1 2 3 4 5 6 7

Use padding that conforms to your body

1 2 3 4 5 6 7

Quality Rating Scale

Quality

Answers to the problem should be rated on a seven point scale based on the following criteria:

Usefulness: Is the idea feasible, useful, or practical?

1 = Extremely Un-Useful

7 = Extremely Useful

Padded Armrests

1	2	3	4	5	6	7

Built in Speakers

1	2	3	4	5	6	7

Head and Neck Rest

1	2	3	4	5	6	7

Create a bubble like shield that can be turned on to ensure a quiet work environment

1	2	3	4	5	6	7

Use padding that conforms to your body

1	2	3	4	5	6	7

Training Evaluation Questions and Answers

Question 1. What is the main difference between subjective and objective scoring methods?

Subjective scoring methods use raters and objective scoring methods use computers.

Question 2. What is Divergent Thinking?

A cognitive process of association that detects creative potential, but not creativity itself.

Question 3. What Divergent Thinking Concept Will You be Utilizing?

Originality

Question 4. What are Alternate Uses Tasks? What are Improvement Tasks?

Alternate uses tasks assess different uses of an object.

An Improvement task assesses how to make a product, process, or service better via some criteria

Question 5. What is the definition of creativity utilized in this study? What are the components definitions?

An idea that is both novel (imaginative, original, different) and useful (feasible, practical)

Question 6. Are there right or wrong answers in subjective scoring methods?

No

Appendix D: Top and Bottom Ideas

Novelty: Alternate Uses of a Hanger – Top 3 Ideas and Bottom 3 Ideas

Idea	Rater 1	Rater 2	Rater 3	Average
Make a race track for your hamster and see if it stay inside the track	7	6	7	6.67
Fairy wings	7	6	7	6.67
Chandelier	6	6	7	6.33
Unlock car door	1	1	1	1.00
Hang clothes on	1	1	1	1.00
Pick lock	2	3	1	2.00

Utility: Alternate Uses of a Hanger – Top 3 Ideas and Bottom 3 Ideas

Idea	Rater 1	Rater 2	Rater 3	Average
Unlock car door	7	7	7	7.00
To hang clothes on	7	7	7	7.00
Poker for food	7	6	7	6.67
Wind chime	1	1	5	2.33
Jewelry	3	2	2	2.33
Surgical rods	2	3	1	2.00

Novelty: Alternate Uses of a Brick – Top 3 Ideas and Bottom 3 Ideas

Idea	Rater 1	Rater 2	Rater 3	Average
Make an obstacle course for a pet	7	6	7	6.67
Jump on a trampoline with it and try not to get hit	7	7	6	6.67
Use them to play life size Jenga	7	6	7	6.67
Décor/Decorations	1	1	1	1.00
Landscaping	1	1	1	1.00
Fire pit	1	1	1	1.00

Utility: Alternate Uses of a Brick – Top 3 Ideas and Bottom 3 Ideas

Idea	Rater 1	Rater 2	Rater 3	Average
Door stopper	7	7	7	7.00
Fire pit	7	7	7	7.00
Weight – basketball hoops	6	6	7	6.67
Make jewelry	2	1	1	1.33
Jump on a trampoline with it and try not to get hit	1	1	2	1.33
Art	1	3	2	2.00

Novelty: Improve Toy Truck – Top 3 Ideas and Bottom 3 Ideas

Idea	Rater 1	Rater 2	Rater 3	Average

Hovering Truck	7	6	7	6.67
Turn into a Transformer	7	7	6	6.67
Include an online interface	7	7	6	6.67
Add sounds	3	2	1	2.00
Add a variety of colors	3	2	1	2.00
Make it larger	1	2	1	1.33

Utility: Improve Toy Truck – Top 3 Ideas and Bottom 3 Ideas

Idea	**Rater 1**	**Rater 2**	**Rater 3**	**Average**
Remote control	4	7	7	6.00
Add lights	6	4	7	5.67
Built in screen	2	6	7	5.00
Cartoon stickers	1	3	7	3.67
Make the doors open and have a way to connect to other vehicles	2	4	5	3.67
Spring loaded	2	4	2	2.67