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Creativity and Performance: The Effects of Working in Groups versus Working Individually

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Abstract

I-O Psychologists are interested in factors that can affect work productivity and performance among an organization's employees. Some professionals argue that two heads are better than one when it comes to being innovative and coming up with creative solutions, however, others state the opposite given that group settings tend to result in many hindering factors such as conformity and production blocking. In the present study, we attempted to determine whether or not there is a differential impact of working groups and working individuals on creativity and performance. This was measured through a divergent thinking task based on Guilford's Alternative Uses Task (1967) and a convergent thinking task based on Mednick's Remote Association Task (1962). Introduction to Psychology students were asked to complete both tasks, once as a group and once as individuals. The alternative uses task asked participants to list as many possible uses for a single common household item within a span of three minutes while the remote association task asked participants to answer a number of questions made up of three words and list the one word that associates the other three together. I hypothesized that participants working in an individual setting will have a higher total mean score on the divergent and convergent thinking tasks than the same participants working on these tasks in a group setting.

Creativity and Performance: The Effects of Working in Groups versus Working Individually

Although the old saying of, “two heads are better than one” suggests the idea that working in groups is better than working by oneself, much of today’s research shows that people tend to be more creative when they work alone. Although many organizations across the globe prefer the idea of employees working in groups, some believe that working as an individual allows for the creative juices to flow. Famous innovators Bill Gates and Steve Wozniak are described as having been more introverted and isolated in their work before becoming the huge successes they are today. When exploring the topic of groups versus the individual, Cain (2012) found that Wozniak mentions the following in his memoir as advice to aspiring inventors:

Most inventors and engineers I’ve met are like me ... they live in their heads. They’re almost like artists. In fact, the very best of them are artists. And artists work best alone.... I’m going to give you some advice that might be hard to take. That advice is: Work alone... Not on a committee. Not on a team. (p. 2)

Not all creative people or innovators are alike however, which makes defining creativity a great challenge. Although the general definition of “creativity” from a psychological view point can be described as, “the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others” (Franken, 1993, p. 396), the idea of creativity and what it involves is much more complex. Since its active study by psychologists beginning in the 20th century, the definition of creativity has been expanded on, become more complex and has been questioned numerous times (Kersting, 2003).

An example of the ever-expanding idea of creativity is the development of the personality-creativity connection theory as mentioned by Dean Keith Simonton, a psychologist at the University of California, who notes a difference between the kind of creativity that helps a sculptor create masterpieces versus the kind of creativity that helps a physicist develop new theories on the origin of the universe (Kersting, 2003). Both types require similar mastery of skills, but personality differences lead individuals to particular pursuits. This leads to the idea that a person may be better able to express their creativity through certain tasks based on their personality. For example, someone who is described as logical and well-reasoned may pursue the physicist route to develop a new creative theory that only strictly follows a scientific process. Someone who is described as more imaginative and expressive, however, may pursue a less constrained artistic route to create an inventive and original piece of art.

It has been suggested that creativity is made up of two types, with one type of creativity being known as “big C” creativity and the other type as “little C” creativity (Paulus & Nijstad, 2003). “Little C” creativity is more common, as it refers to one’s everyday problem solving and ability to adapt to change, while “big C” creativity is considered rarer as it is experienced only when one solves a problem that has never been solved before or creates a new object, idea, etc. that has a profound impact on society. While “big C” creativity can be considered more impressive given its rarity, both types are important when it comes to being creative, as most challenges that people face on an everyday basis involve “little C” creativity. Therefore, “little C” creativity will be the type of creativity tested in this study.

The scientific study of creativity is a very important factor to many organizations and is often taken into consideration in organizational decisions. This is because creativity is what sets businesses or organizations apart from one another. Without creativity or innovation, every

company would follow the same patterns in marketing, selling techniques, and the goods and services sold. The demands of customers are constantly changing and customers have higher expectations, therefore organizations need to keep up with these demands through new, creative products or services. The idea of whether creativity is more likely to be experienced because of a group process or because of individuals working independently has become a main concern for organizations as they rely heavily on innovation as a key factor in their success.

An important component of groups that allows for creativity is the influence of peers on cognitive and motivational processes (Paulus, Dzindolet, & Kohn, 2012). Hearing a group member's idea has the potential to cognitively stimulate another group member to be creative and come up with his or her own creative idea. This leads to the idea that exchanging information or idea bouncing allows for innovative or creative potential, as sharing ideas with one another can lead to further thought or allow for one big creative solution created from multiple shared ideas.

Laughlin, Hatch, Silver, & Boh, (2006) reported that groups of three, four, or five performed better on complex problem solving than the best of an equivalent number of individuals. These groups outperformed the best individuals in solving letters-to-numbers coding problems and this performance was attributed to the ability of people to work together to generate and adopt correct responses, reject erroneous responses, and effectively process information. Let it be noted in the present research however that the tasks given are not considered to be "complex". Both the alternative uses task and remote association task have a clear set of instructions and very obtainable goal.

Diversity is another big plus when it comes to creative potential in groups. The word itself refers to a variety or a range of different things. By having a diverse group, there is a

diverse mindset that allows for all sorts of thinking strategies that ultimately generate more creative ideas. Diversity enhances creativity as it encourages the search for novel information and perspectives, leading to better decision making and problem solving (Phillips, 2014).

Thus, there is research that provides evidence that groups do contribute to creative potential. However, there is another body of research that tends to support the idea that individuals are more creative when they work alone. This research suggests that there are several factors related to group functioning that can hinder the creative building process. According to Thompson (2015), there are four factors that can lead groups to be less creative than individuals, such as social loafing or the evidence that participants working in groups tend to exert less effort than participants working individually. Therefore, social loafing becomes more of a problem as the team or group becomes bigger. It's easy to feel less obligated to do work when others are around to do it for you.

There is also the problem of conformity, which often occurs without conscious awareness. Conformity can be described as the adjustment of one's behavior to align with the norms of the group (Robbins & Judge, 2015). People bringing their behavior in line with what they feel will win them acceptance in a group can result in a less creative mindset, as one will prioritize acceptance over creativity if it means differing from the group. For example, Fleming and Zizzo (2011) found that conformity in a group did not lead to quality teamwork, and that people who do not conform are more likely to work together for the greater good. They measured participants' conformity levels through a standardized measure and then let them play a game afterwards that allowed them to choose whether to contribute financially to the public good. Partnered participants were matched for conformity and had to decide how much to contribute to a fund for the public good. Results showed that individuals who were highly

conforming were unlikely to pay more than their partner paid previously, and less conforming individuals were willing to not acknowledge their partner's investment and to invest more.

Another issue is production blocking, which refers to anything that interferes with a person's ability to fully focus on the given task at hand, such as other people in a group. When working in groups, some attention is going to be needed to be given to others in order to work together and this distracts from the work itself. A study by Nijstad & Stroebe (2003) identified production blocking as an important cause of productivity loss in brainstorming groups due to the disruption of idea generation when delays were relatively long.

Lastly, performance matching is also known to hinder creativity in a group setting, as members of a group are likely to quickly converge on a group average. In particular, the lowest performing members are known to be influential, an experience known as downward norm-setting (Thompson, 2015).

Research in support of increased creativity in individuals includes a meta-analysis that compared individuals and groups on brain storming activities. Researchers compared group totals to individual totals by judging productivity in terms of both quantity and quality. The results showed that those who worked alone generated about two and a half more ideas than those who worked in groups, and a significantly greater percentage of the ideas generated by individuals were judged to be of higher quality than those of the groups (Diehl & Stroebe, 1987).

In terms of individual performance, privacy is known to be quite helpful for productivity according to a study done by DeMarco and Lister (1987). This study compared 600 computer programmers at 92 companies and found a significant performance gap between organizations as programmers of top-performing companies experienced more privacy, personal workspace, and

freedom from interruption. Sixty-two percent of the best performers said their workspace was sufficiently private compared with only 19 percent of the worst performers (Thompson, 2015). While groups can experience privacy as well, the privacy experienced in this group setting will not be significant in terms of avoiding distraction – such as from others – as when working by oneself. Working in a group means working with other people which leads to questions and comments between members. While such questions and comments can be concerned about the work, they ultimately take attention away from the work itself and distract other group members who aren't asking the questions or making comments. This goes for conversations that aren't related to the task at hand as well.

There is more research in considering what makes for effectiveness in groups versus individuals. Paulus, Dzindolet, & Kohn (2012) note that while groups can be highly innovative through efficiently and adequately sharing knowledge with each other, it may take considerable training and experience for groups to excel at group creativity. While studies of creativity in short-term groups suggest that groups will often underperform, these studies also suggest that groups that are suited for groupwork or groups that have worked together for a significant amount of time should be able to achieve synergistic outcomes. “For teams or groups to be effective, they need to have effective cognitive processes, be cohesive, have a sense of efficacy, coordinate their activities, have effective task structure, have goals and feedback, be trained, and have appropriate leadership” (Salas, Rosen, Burke, & Goodwin, 2009; Tasa, Taggar, & Seijts, 2007). Given this, we can see there a lot of factors that go into what makes a group an effective. Therefore, these factors should be considered before deciding on using a group setting.

According to a study performed by Jaarsveld, Lachmann, and van Leeuwen (2012), the highest levels of creativity require both convergent thinking and divergent thinking; two

important components of creativity. The researchers found that intelligence tests alone are a nonreliable way of measuring creativity as they fail to measure divergent thinking. Therefore, using tasks that require one to use both types of thinking are good indicators of creativity as convergent thinking requires solutions that converge with or are restricted to what is presented to you, while divergent thinking requires one to generate many possible ideas by exploring many possible solutions. Thus, divergent and convergent thinking tasks will be used in this study simply as a way of measuring creativity.

Divergent thinking is the ability to consciously generate new ideas that branch out to many possible solutions for a given problem. These solutions or responses are then scored on four components: originality, fluency, flexibility, and elaboration. Divergent thinking tests in comparison to any other tests of creativity are used the most often as reliable assessments of creative potential (Runco, 2012).

Convergent thinking is the ability to correctly choose the single correct solution to a problem. Creative convergent thinking often requires taking a novel approach to the problem, seeing the problem from a different perspective, or making a unique association between parts of the problem. Convergent thinking is of particular importance as it a source of ideas, suggests pathways to solutions, and provides criteria of effectiveness and novelty (Cropley, 2010).

Based on this research, the current study hopes to assess individuals versus groups in terms of performance and creativity through convergent and divergent thinking tasks. While there are benefits to both group and individual work, there are dynamics about group interaction that can hinder performance and creativity, thus the following hypothesis is proposed:

Hypothesis: Participants working in an individual setting will have a higher score on measures of divergent and convergent thinking than the same participants working on divergent and convergent tasks in a group setting.

Method

Participants

Participants included 39 undergraduate college students (26 women and 13 men) from two small, private, Midwestern, Catholic, liberal arts colleges. Participants were recruited through Introductory Psychology courses and received partial course credit for participation. All participants participated in both a group performance setting and in an individual performance setting.

Materials

Participants were asked to take part in an experiment that tests the effects of working in groups vs. working as individuals on creative performance and level of creative potential. This was assessed through a divergent thinking task based on Guilford's Alternative Uses Task (1967) and a convergent thinking task based on Mednick's Remote Association Task (1962). The alternative uses tasks involved asking participants to list as many possible uses for a single common household item such as a newspaper and jar within a span of three minutes. The remote association task involved participants being presented with three words and asked to come up with the word that associates the other three together. For example, a participant could be presented with the words, "cottage", "blue," and "mouse", and the correct response that associates these words would be "cheese." Only correct responses were given credit. The 40 questions used for this task were taken from a web site ("Remote Associates Test," n.d.) which

offers a collection of tasks from the Remote Associates Test of Creativity. Tasks on the site were each given a level of difficulty and were labeled as the following: “Very Easy”, “Easy”, “Medium”, or “Hard”. Five tasks were chosen from each level of difficulty for a total of 20 tasks. The tasks for each sheet are in order from “Very Easy” to “Hard” and therefore became harder as the participants progressed through the task.

Procedure

The experiment was run in sessions of 6-7 participants at a time (note that a small number of participants were used for each run for practical reasons in that only a limited number of students are available to be tested at one time). Upon arrival, participants first completed a consent form and then were seated at a desk to listen for further instructions. The experimenter then verbally gave all participants the complete set of instructions on how to complete all given tasks in both a group setting and the individual setting (see Appendix A). Participants were told that when in a group setting, they may speak among themselves and communicate with one another to work together and solve the given task. Participants were told that when in an individual setting, participants must not communicate with each other by any means and must work alone when attempting to solve the given task. Everybody attempted both pairs of one set of alternative uses task and one set of remote association tasks. In other words, participants attempted both *Alternative Uses Task #1* and *Remote Association Task #1* as a set of tasks or *Alternative Uses Task #2* and *Remote Association Task #2* as a set of tasks. Each set of tasks was done in a group setting for one group of participants and in an individual setting for the other group of participants, depending on which condition they were randomly assigned to at the start of the session. Participants were randomly assigned to one of the sets of tasks mentioned above either as a group for one set of tasks and as individuals for the other set of tasks. Participants

were randomly assigned to work on these tasks in one of two groups: a group of three who work together or a group of three who work as individuals. For the sake of making the rest of this procedure clear, the group of three who work together will be known as “group 1” and the group of three who work as individuals will be known as “group 2.” Let it be noted that some groups who participated in this experiment were in a group of 4.

After randomly assigning groups and providing the instructions, group 1 was directed to go to another room to wait for the experimenter to follow soon after to begin their task; this changed for each new session. For example, one complete session began with asking group 1 to go to the next room and wait, while the next complete session with a new set of six participants began with asking group 2 to go to the next room and wait. As the experimenter, I always began in the room with the group who stayed seated and wasn’t directed to leave to go to the next room. After group 1 left the room to wait, Alternative Uses Task #2 was handed out and the directions were read to group 2 that were specific for group 2 for this task, i.e., the directions that pertain to a group who works as individuals on Alternative Uses Task #2. I then let them know that they could begin the task in front of them as I started the timer. I waited until the three-minute time limit was up and then collected papers. I then handed out papers for the next task or Remote Association Task #2. I then read the directions that were specific for group 2 for this task – i.e., the directions that pertain to a group who works as individuals on Remote Association Task #2. I then let them know that they could begin the task in front of them as I started the timer.

After starting group #2, I head over to the next room to start group #1, while keeping the time running for group #2. I then handed out Alternative Uses Task #1 and read the directions that were specific to group 1 for this task – i.e., the directions that pertain to a group who works

together on Alternative Uses Task #1. I then let them know that they could begin the task in front of them as I started the timer. I waited until the three-minute time limit was up and then collected papers. I then handed out papers for the next task or Remote Association Task #1. I then read the directions to group 1 that were specific for group 1 for this task – i.e., the directions that pertain to a group who works together on Remote Association Task #1. I then let them know that they could begin the task in front of them as I started the timer. After starting group #1, I headed back to group #2 to finish waiting out the ten-minute time limit and collect papers afterwards. After collecting papers from group #2, I told them to stay seated and wait as I headed back to group #1 and waited out their ten-minute time limit and then collected papers afterwards.

After collecting papers from group #1, the next stage of the study could begin where groups would change group settings and complete another pair of the same types of tasks. For example, participants who just worked as group #1 on *Alternative Uses Task #1* and *Remote Association Task #1* would now work as group #2 on *Alternative Uses Task #2* and *Remote Association Task #2*. Participants who just worked as group #2 on *Alternative Uses Task #2* and *Remote Association Task #2* would now work as group #1 on *Alternative Uses Task #1* and *Remote Association Task #1*. This technique of counterbalancing allowed for all possible orders of presenting the tasks and avoided task order determining results.

This process began with after collecting papers from group #1, and then giving group #1 Alternative Uses Task #2 and being instructed to work on it now as individuals. I then let them know that they could begin the task in front of them as I started the timer. I waited until the three-minute time limit was up and then collected papers. Next, I handed out papers for the next task or Remote Association Task #2. I then read the directions that pertained to working as individuals on Remote Association Task #2. I then let them know that they could begin the task

in front of them as I started the timer. After starting the timer for group #1, I then head back to group #2, while keeping the time running for group #1. I then handed out the papers for Alternative Uses Task #1 and instructed group #2 to work in their newly formed group as members who work together. I then let them know that they could begin the task in front of them as I started the timer. I would wait until the three-minute time limit was up and then collected papers. Next, I would hand out papers for the next task or Remote Association Task #1. I would then read the directions that pertain to a group who works together on Remote Association Task #1. I would then let them know that they could begin the task as I started the timer. I would then head back to group #1 and wait out the rest of the ten-minute time limit and collect papers afterwards. After collecting papers from group #1, I would tell them to stay seated and wait as I head back to group #2 and wait out the rest of their ten-minute time limit and collect papers afterwards. Once this was complete, I would bring all participants back together in the same room and let them know that they have finished. They were then be debriefed and thanked for their participation.

The instructions for the alternative uses task included letting participants know that they would be given a piece of paper with a single common household item on it and they are to write down as many uses for it as they can on the piece of paper in the span of three minutes. Instructions for the remote association task involved participants being told that they would be given a list of twenty questions with each consisting of three words and to write down the one word that the three words are associated with in a span of 10 minutes.

Scoring of the alternative uses task included originality, fluency, flexibility, and elaboration. For originality, each response was compared to the total amount of responses from all participants and responses that were given by a smaller percentage of total participants would

be worth more and those given by a larger percentage of total participants would be worth less. More specifically, “unique” group responses were awarded 2 points, meaning that no other group came up with the same response, while “unusual” group responses were worth 1 point, meaning that only one other group came up with the same response. For individuals, “unique” responses were awarded 2 points if only given by 2 other individuals and “unusual” responses were awarded 1 point if given by more than 3 individuals, but less than 6. This point system was developed to fit this experiment based on the original scoring system of Guilford’s Alternative Uses Task (1967). Fluency is measured by the total amount of responses in the given time limit. The more valid responses that are given (“valid” meaning that it appears to the experimenter to be physically possible for the given item to be used in this way and serves a purpose), the more points that will be awarded. Flexibility will be measured based on the number of various categories. For example, a broomstick being used as both a weapon and to hit an intruder in your house would both fall under the general idea of weapon. The more categories given, the higher or better a group will score on this component. Elaboration will be measured by the amount of detail in each response. For example, “a doorstep” would be worth less compared to “a doorstep to prevent a door slamming shut in a strong wind.” The more detail a response appears to have according to the experimenter, the more it will be worth. More specifically, if a response is given an explanation along with it, it will be worth 1 point. If there is further detail on top of this, it will be awarded 2 points. Measurement or scoring for the remote association task will simply involve giving credit only to correct responses for each question. The higher the score earned, the higher amount of creativity indicated.

Results

A one sample t-test was used to determine whether there was a significant difference between the group condition and the individual condition in terms of creative potential determined through scores on the alternative uses task and remote association task. This included four different scores for the alternative uses task: originality, fluency, flexibility and elaboration. There was one score for the remote association task. For both the alternative uses task which included all four components and the remote association task, difference scores were calculated comparing group condition scores vs. individual condition scores. So for example, if in one session participants #1, #4, and #5 earned a group score of 10 for one task and participants #3, #2, and #6 earned a group score of 15 for the same task, these group scores were subtracted from each of their individual scores. These difference scores are seen in the graph below and labeled as such: “OD” meaning originality difference, “FD” meaning fluency difference, “FLD” meaning flexibility difference, etc. In summary, a difference score was calculated for all four components of the alternative uses task between groups and individuals, as well as for the remote association task between groups and individuals. This can be seen in the One-Sample Test Table. (See Appendix B)

Contrary to the hypothesis, groups scored significantly better than individuals on both types of tasks. In terms of the four components of the alternative uses tasks, groups scored better on originality ($t = -4.223$, $df = 38$, $p < .00$), fluency ($t = -10.165$, $df = 38$, $p < .00$), flexibility ($t = -12.929$, $df = 38$, $p < .00$), and elaboration ($t = -2.651$, $df = 38$, $p < .00$). Groups also scored significantly better than individuals ($t = -16.108$, $df = 38$, $p < .00$) on the remote association task.

Discussion

I hypothesized that participants working in an individual setting would have a higher total mean score on the divergent and convergent thinking tasks than the same participants working on these tasks in a group setting. Although this was not the case, I did find significant results in the opposite direction of my hypotheses, as groups performed better than individuals on both types of tasks.

In reviewing these results, there are many factors to consider. Although there are hindering factors to creativity in a group setting such as conformity, social loafing and production blocking, these factors are likely to be more impactful in a larger group setting. For practical reasons surrounding participant recruitment, groups were defined as three or four people. However, in typical organizational settings, there likely would be a much larger group setting that would make hindering factors of a group more apparent. With a larger number of people comes a greater likelihood of people pushing off work, diffusion of responsibility, etc.

Production blocking would be more likely to occur in a larger group setting as with more people in a group, the more distractions there are that take attention away from the task at hand. When working with other people in a group, some attention is going to have to be given to those around you in order to work with them which ultimately takes attention away from the job. Therefore, the more people you work with in a group, the more attention you will have to give up for others. Social loafing is also more likely in a larger group since one is less likely to feel inclined to contribute as there are many others who can contribute instead. This can also be applied to conformity as with more people thinking the same ideas, the more likely it would be that others would follow. For example, if a large amount of people in a group setting tend to have the same general idea, others may feel inclined to follow this idea although they may not entirely

agree, but decide to do so out of fear of being in the minority or speaking up against what the majority believes in.

Significant Results

As mentioned in the literature, there are benefits to group settings that likely added to their success in this experiment. This includes the influence of peers on one another, such as on their cognitive and motivational processes. When in a group setting, participants tend to bounce ideas off of each other and prompt further thought in one another when attempting the tasks as seen in the research of Paulus, Dzindolet, & Kohn as well (2012). When hearing a fellow group member's idea, it is possible that this has the potential to cognitively stimulate one's own mind and lead to other creative ideas or solutions. Multiple shared ideas can lead to one big creative solution.

It is also logical that with more people present, the more likely it is that someone could come up with the correct response for the remote association task or that a larger array of responses could be developed for the alternative uses task. This is simply due to the fact that with more people present, the higher chance that a solution can be found with more minds attempting to solve the problem at hand, along with each person adding another perspective.

This leads to another benefit of groups: diversity. It is expected that participants are still unique in each of their own ways and come from different backgrounds as no two humans are exactly alike. Therefore, bringing people together in a group adds a new level of perspective with each added participant. As Phillips noted in his research, diversity enhances creativity as it encourages the search for novel information and perspectives, leading to better decision making and problem solving (2014). This was taken note of throughout the experiment as participants in

group settings would bring different ideas to the table based on their own past and unique experiences.

Limitations

Like most studies, this one is not without limitations. As mentioned before, the small sample size poses a significant risk as the study was underpowered and the outcome of the groups performing significantly better than individuals was possibly due to small group sizes as hindering factors of group settings are more apparent in larger group sizes. If more participants were to have been used, hindering factors could have had a greater impact on groups and therefore reinforce the idea that said factors such as production blocking, conformity, and social loafing contribute to deescalating the creative process in groups. Let it be acknowledged however that groups can and are known to perform better than individuals under certain circumstances.

There was also the limitation of the evaluator having to judge some of the test criteria in order to determine if responses are worth more or less although this was done to the evaluator's best ability. This involved scoring all four components of the alternative uses task. For originality, the researcher did his best in determining which responses were unique from one another and which were basically the same idea. For example, participants said a jar could be used to hold many different items ranging from liquids/food to office supplies. However, these responses all serve the same purpose of holding an item and therefore were not considered to be original. For fluency, as long as the response was physically possible for the item to be used in that way, points were awarded. For flexibility, the evaluator attempted to determine which responses would be considered to be under the same category or idea. Using the previous jar example again of holding many different ideas, these responses would all be considered to be

under the same general idea of “holder”. However, if a response was given saying that the jar could be used to measure different ingredients, this would be considered a different category as while it is still holding something inside, it’s also serving another purpose of measuring what’s inside. As for elaboration, if a response was given an explanation along with it then a point was earned. If extra detail was given on top of this, another point was added. Overall, a main limitation was in fact that the researcher was the only evaluator of the scoring criteria for both tasks.

Future Research

Future research should continue to examine the effects of groups and individuals on creativity and performance, as this study gave some, but limited, insight into the issue or phenomenon. This research simply tested participants in individual and group settings on creativity measuring tasks. Perhaps future research could look more into under what conditions groups and individuals are more creative. Groups that have experience together through training and are more cohesive could be tested against individuals who are more introverted and have characteristics closely related to known innovators. This would test the strengths of both settings, as groups who have had time to build relationships with each other and know how one another work in a group setting would likely make the group more productive and have a greater chance of coming up with creative solutions, while those who are extremely introverted tend to work best on their own, especially if they have traits similar to known introverted innovators such as Steve Wozniak.

Another direction this research could take would be to compare groups versus individuals on “big C” creativity rather than “little C” creativity. “Big C” creativity would involve solving a

problem that has never been solved or creates a new object or idea rather than solving basic, common problems as used in this research.

It would be beneficial for future research to continue to explore this topic as many organizations and companies rely heavily on creativity and innovation for their accomplishments. Whether or not these workers perform better in a group setting or as individuals can be crucial to the success of organizations. Many other factors can come into play, such as one's personality characteristics or whether they are introverted or extraverted, so it is important that businesses explore this topic and see what works best for their company when it comes to their employees as the future of business depends on it.

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Alternative Uses Task #1**Newspaper**

- | | |
|-----|-----|
| 1. | 21. |
| 2. | 22. |
| 3. | 23. |
| 4. | 24. |
| 5. | 25. |
| 6. | 26. |
| 7. | 27. |
| 8. | 28. |
| 9. | 29. |
| 10. | 30. |
| 11. | 31. |
| 12. | 32. |
| 13. | 33. |
| 14. | 34. |
| 15. | 35. |
| 16. | 36. |
| 17. | 37. |
| 18. | 38. |
| 19. | 39. |
| 20. | 40. |

Alternative Uses Task #2**Jar**

- | | |
|-----|-----|
| 1. | 21. |
| 2. | 22. |
| 3. | 23. |
| 4. | 24. |
| 5. | 25. |
| 6. | 26. |
| 7. | 27. |
| 8. | 28. |
| 9. | 29. |
| 10. | 30. |
| 11. | 31. |
| 12. | 32. |
| 13. | 33. |
| 14. | 34. |
| 15. | 35. |
| 16. | 36. |
| 17. | 37. |
| 18. | 38. |
| 19. | 39. |
| 20. | 40. |

Remote Association Task #1

1. Night / Wrist / Stop _____
2. Duck / Fold / Dollar _____
3. Rocking / Wheel / High _____
4. Dew / Comb / Bee _____
5. Fountain / Baking / Pop _____
6. Aid / Rubber / Wagon _____
7. Flake / Mobile / Cone _____
8. Safety / Cushion / Point _____
9. Dream / Break / Light _____
10. Fish / Mine / Rush _____
11. Sense / Courtesy / Place _____
12. Flower / Friend / Scout _____
13. Pie / Luck / Belly _____
14. Opera / Hand / Dish _____
15. Fox / Man / Peep _____
16. Piece / Mind / Dating _____
17. Stick / Maker / Point _____
18. Dust / Cereal / Fish _____
19. Right / Cat / Carbon _____
20. Cross / Rain / Tie _____

Remote Association Task #2

1. Cottage / Swiss / Cake _____
2. Cream / Skate / Water _____
3. Loser / Throat / Spot _____
4. Preserve / Ranger / Tropical _____
5. Cracker / Fly / Fighter _____
6. River / Note / Account _____
7. Print / Berry / Bird _____
8. Cadet / Capsule / Ship _____
9. Fur / Rack / Tail _____
10. Hound / Pressure / Shot _____
11. Light / Birthday / Stick _____
12. Shine / Beam / Struck _____
13. Peach / Arm / Tar _____
14. Palm / Shoe / House _____
15. Wheel / Hand / Shopping _____
16. Chamber / Mask / Natural _____
17. Office / Mail / Hat _____
18. Age / Mile / Sand _____
19. Catcher / Food / Hot _____
20. Tank / Hill / Secret _____

Remote Association Task #1 Answers

1. Watch
2. Bill
3. Chair
4. Honey
5. Soda
6. Band
7. Snow
8. Pin
9. Day
10. Gold
11. Common
12. Girl
13. Pot
14. Soap
15. Hole
16. Game
17. Match
18. Bowl
19. Copy
20. Bow

Remote Association Task #2 Answers

1. Cheese
2. Ice
3. Sore
4. Forest
5. Fire
6. Bank
7. Blue
8. Space
9. Coat
10. Blood
11. Candle
12. Moon
13. Pit
14. Tree
15. Cart
16. Gas
17. Box
18. Stone
19. Dog
20. Top

Appendix A

Directions for each task and group setting

Groups who work as individuals on Alternative Uses Tasks: This task in this group setting requires that you work alone as individuals to come up with as many uses as you can in 3 minutes for the item listed on the sheet. Working alone means you are not allowed to speak or communicate with one another by any means while attempting the task. Valid responses for this task are uses that are judged by the experimenter to be physically possible and serve a purpose.

Groups who work as individuals on Remote Association Tasks: This task in this group setting requires that you all work alone as individuals to answer every question listed on the given sheet. Working alone means you are not allowed to speak or communicate with one another by any means while attempting the task. Your goal for each question is to come up with the one word that correctly associates all three given words. For example, the correct response to the words “broken”, “clear” and “eye” would be “glass”. You will have ten minutes to complete this task.

Groups who work together on Alternative Uses Tasks: This task in this group setting requires that you all attempt to work together to come up with as many uses as you can in 3 minutes for the item listed on the sheet. Working together means you are all allowed to speak and communicate with one another in any way that you feel helps contribute to thinking of and giving a valid response for the task at hand. Valid responses for this task are uses that are judged by the experimenter to be physically possible and serve a purpose.

Groups who work together on Remote Association Tasks: This task in this group setting requires that you all attempt to work together to answer every question listed on the given sheet. Working together means you are all allowed to speak and communicate with one another in any way that you feel helps contribute to thinking of and giving the correct response to each question. Your goal for each question is to come up with the one word that correctly associates all three given words. For example, the correct response to the words “broken”, “clear” and “eye” would be “glass”. You will have ten minutes to complete this task.

Appendix B

One-Sample Test

Test Value = 0

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
OD	-4.223	38	.000	-2.02564	-2.9967	-1.0546
FD	-10.165	38	.000	-6.69231	-8.0250	-5.3596
FLD	-12.929	38	.000	-4.64103	-5.3677	-3.9143
ED	-2.651	38	.012	-1.12821	-1.9897	-.2668
RAD	-16.108	38	.000	-8.92308	-10.0445	-7.8017