In Search Of Better Brainstorming

Through A Two Step Process

by

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ABSTRACT

Much of the literature and many of the studies surrounding brainstorming focus on the performance and the quantitative aspects of the process in comparing the efficacy of individual versus group settings, specifically the benefits and pitfalls associated with each. This study looked at using alternate combinations of both individual and group styles of brainstorming to most efficiently maximize production of ideas and satisfaction of participants, while minimizing obstacles and shortcomings typically seen in brainstorming sessions. This research was designed to compare results of three different aspects of these sessions: real efficacy, perceived efficacy, and participant satisfaction.

Two cohorts of eight student volunteers each were used to participate in and evaluate the specific session sequence they attended, either that of group then individual or individual then group. Each cohort consisted of four introverts and four extroverts, and the results and responses of each were then compared against each other in the same session and then against the results of the other session to see if there was a difference between the two personality types.

The findings of this research revealed that the brainstorming session sequence of group then individual generated a larger quantity of solutions to the given problem and was perceived as more effective by both introverts and extroverts. The study also showed that introverts self-reported a higher satisfaction for the session ending in individual brainstorming, while the extroverts preferred the session ending with the group brainstorming.

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Chapter 1

INTRODUCTION

"The problem with brainstorming is that everyone thinks that they already do it" (Kelly & Littman, 2001).

The practice of "brainstorming," as originally developed by advertising executive Alex F. Osborn in the 1930s, has become one of the best known and most often used creative problem solving tools available to assist in the generation of new ideas or solutions surrounding a given problem. Brainstorming has become increasingly popular in organizational settings in part due to its seemingly simple process and perceived efficacy, with corporate leaders believing that brainstorming will lead to more ideas generated and overall greater efficiency, quality, production, and enthusiasm (Rowatt, Nesselroade Jr., Beggan & Allison, 1997; Taylor, Berry & Block, 1958).

Much of the literature and many of the studies surrounding brainstorming focus on the performance and the quantitative aspects of the process in comparing the efficacy of individual versus group settings, specifically the benefits and pitfalls associated with each. This study looked at using alternating combinations of both individual and group styles of brainstorming to most efficiently maximize production of ideas and satisfaction of participants, while minimizing obstacles and shortcomings typically seen in brainstorming sessions.

Justification for the research

During a research methods class taken early in my graduate studies, students were asked to participate in a brainstorming session to come up with as many uses as possible for a common No. 2 pencil. The class was divided in two, with half staying in the room to brainstorm solutions as a group, and the other half sent out to generate ideas on their own individually. Based on common misperceptions, it is possible that the instructors had been fully expecting the group session to be the more successful of the two, but instead, one of the students acting on his own generated more ideas alone than the entire group did together. Granted, it may have been the exception rather than the rule, but it was this instance that inspired me to pursue this line of research questioning.

Since the original concept of brainstorming was published by Osborn in his book *Applied Imagination* (Osborn 1953), there have been a numerous studies conducted to determine the efficacy of the brainstorming process, focusing on the benefits and pitfalls associated with both individual and group brainstorming methods (Rowatt, Nesselroade Jr., Beggan & Allison, 1997).

My study proposed to look at using a combination of the two methods (nominal group and real group) to minimize the drawbacks of each while capitalizing on the positive attributes they both have to offer.

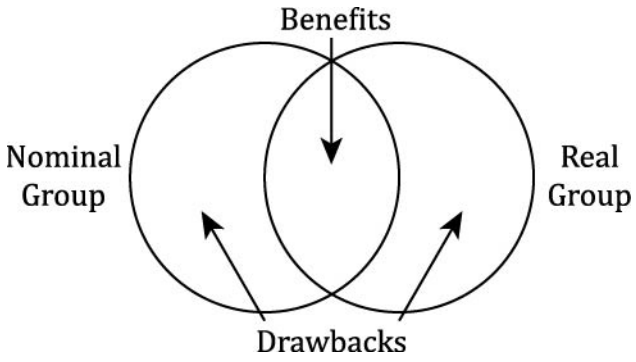

Figure 1. Conceptual Framework

While using both individual and group methods of brainstorming for this study, it had also been looked at how two personality types, Introverts and Extroverts, perceive the efficacy of the two sessions. Being an introvert myself, I am interested to see if other introverts prefer and feel more effective working alone, and if extroverts have the opposite preferences and perceptions.

Research Problems and Hypothesis

This study looked at three different aspects of brainstorming, those of real efficacy, perceived efficacy, and participant satisfaction with each process.

Real Efficacy

Which is the most effective two-step alternating sequence of brainstorming sessions that will produce the greater number of unique ideas?

Hypothesis

1: The sequence of real group session followed by nominal group (individual) session will produce the greater number of ideas.

Perceived Efficacy

Which session sequence will be perceived by the participants as being most effective?

Hypotheses

2: For the introverts, the brainstorming sequence of group session followed by individual session will be perceived as more effective than that of the individual then group session.

3: For the extroverts, the brainstorming sequence of individual session followed by group session will be perceived as more effective than that of the group then individual session.

Satisfaction

Which session sequence will produce a higher level of self-reported satisfaction with the results of the brainstorming session?

4: For the introverts, the brainstorming sequence of group session followed by individual session will be self-reported as more satisfying than that of the individual then group session.

5: For the extroverts, the brainstorming sequence of individual session followed by group session will be self-reported as more satisfying than that of the group then individual session.

Methodology

"Another simple but effective way to induce imaginative effort is to make notes. For the purpose of moving our minds, pencils can serve as crowbars" (Osborn, 1953).

One method I found particularly apt for this study was that of "Stick 'Em Up Brainstorming": using Post-It Notes to record ideas and then "Stick 'Em Up" on a common wall for the entire group to access. Participants will (1) write down their idea, (2) say their idea out loud, and then (3) post the idea on the wall. Saying the idea out loud makes it possible to trigger ideas or connections in others, while using Post-It Notes to capture the idea makes it easier to review and sort later, allowing for easy moving and rearranging of ideas to group similar elements or threads. It will make it easier on me as a facilitator since participants will be writing down exactly what they want to say and I (or a designated scribe) will not be slowing down the ideation process by not able to write fast enough. It also allows for the building on of others' ideas by making all the generated ideas visible to the entire group (Creative Education Foundation, 2010; Isaksen, Dorval, & Treffinger, 2011).

Definitions

In order to add clarity, key terms referenced throughout the rest of the document are outlined below.

Brainstorming

Interactive Brainstorming is one of the most often utilized problem solving techniques used to generate solutions for a given problem. It typically involves gathering a group of people together to verbally interact with the intention of "…using the brain to storm a creative problem–and to do so in a commando fashion, with each stormer audaciously attacking the same objective" (Osborn, 1953).

Nominal Group Technique

Nominal group technique is a non-interactive form of brainstorming involving a collection of individual participants working to generate ideas in the presence of others but do not interact verbally (Rickards, 1999; Rowatt, Nesselroade Jr., Beggan & Allison, 1997; Van de Ven & Delbecq, 1971). For ease of understanding, this will most often be simplified and referred to as "individual brainstorming."

Sequence G-I / Sequence I-G

The two sessions of brainstorming will be referred to by the sequence the of techniques used; G-I will refer to the sequence of Group brainstorming and then Individual brainstorming and I-G will refer to the alternate sequence of Individual brainstorming first and Group brainstorming second.

Production Blocking

Production blocking refers to when group members must take turns to express their ideas and are unable to express their ideas at the time they choose. It has been shown that when individual members must wait their turn to express their ideas soon after they are generated, "productivity strongly declines" (Nijstad & Stroebe, 2006; Diehl & Stroebe, 1987).

Evaluation Apprehension

Despite explicit instruction not to criticize ideas, *evaluation apprehension* may occur when individuals still get anxious about sharing their ideas with the group (Nijstad & Stroebe, 2006).

Free Riding

Free riding is the tendency of group members to let others do the majority of the work because one cannot be individually held accountable for their performance within the group (Nijstad & Stroebe, 2006; Diehl & Stroebe, 1987).

Social Matching

Social matching is what happens when typically high-performing group members tend to match the rate of idea production of lower-performing members (Nijstad & Stroebe, 2006).

Involvement

Involvement refers to the level of participation by the participants in each of the sessions, as determined by number of ideas generated during the sessions (both individual and group).

Satisfaction

Satisfaction is the self-reported level of contentment with the perceived efficacy of the sessions and the experience as a whole.

Meyers-Briggs Type Indicator (MBTI)

The Myers-Briggs Type Indicator is a widely used instrument based on C.G. Jung's theory of psychological types to determine basic personality types, two of which are those of Introvert and Extrovert.

Introvert

The *introvert* personality preference describes one who is renewed and re-energized by being by themself and enjoys the inner world of concepts and ideas.

Extrovert

The *extrovert* personality preference describes one who is energized by their interaction with others and tends to prefer the external world of people and things.

Delimitations of scope and key assumptions

While many styles and tools may be used in the brainstorming process, for the purposes of this study, only brainstorming sessions utilizing the Individual and Group Techniques in conjunction with the "Post-It" activity will be used.

According to Alex F. Osborn, the ideal size of a brainstorming group should be between five and ten persons. (Osborn, 1953 p.304) For this study eight participants were used for each group.

Participants were pulled from a pool of student volunteers from Arizona State University's GRA440 Designing Life course. Participants were solicited from this class based on the assumption that they would have a common general history of attendance at The Design School, would be of an upper class level (Junior or Senior), would have taken and have access to their Myers-Briggs Type Inventory information, and would fall within a generally accepted age range for the level of the class.

For the purposes of this study, only one of the four Meyers-Briggs Type Inventory pairs was looked at, those of Extrovert and Introvert. This was done in order to limit the data examined when evaluating the participant satisfaction surveys with regard to the individual or group brainstorming sessions.

In choosing a topic for the participants to brainstorm, a number of factors were considered. First, the topic should be something that all participants would have had some experience with. Second, it should be broad enough to allow for a very wide variety of solutions without participants feeling too constrained or limited. Finally, it should be a topic that is universally considered to be in need of improvement. Ultimately the topic for the brainstorming sessions, "ways to improve airline travel", was chosen under the

assumption that all of the participants would have had a wide variety of experiences (good or bad) from which to draw upon and would have little trouble thinking of ways to improve future experiences.

For this study, it was believed that using the same facilitator for the group sessions, the same settings for the individual and group sessions, and access to the same materials for each group in each session would provide a balanced experience for both Session 1 (Sequence G-I) and Session 2 (Sequence I-G).

Chapter 2

LITERATURE REVIEW

Brainstorming

Brainstorming is one of the best known and most often used creative problem solving tools available to assist in the generation of new ideas or solutions surrounding a given problem. Some of the many useful applications for brainstorming include: generating solutions to a given existing problem (problem solving), investigating possible causes of a situation or event (problem finding), or for conceptualizing new innovative products, improvements to existing ones, or new processes for accomplishing a desired end result.

The concept of "brainstorming" is associated with many different meanings, processes, and desired outcomes for anyone participating in the act. The details of how to generate ideas with brainstorming can be broken down even further according to what rules and guidelines it is following: Is it being moderated or facilitated? Is it being done by individuals or a group? Is it being done in real-time in person, or is it being done electronically over a longer sporadic period of time?

This section will explain some of the history of, benefits attributed to, and shortcomings observed, surrounding the process of brainstorming. Ultimately, it should be remembered that brainstorming has become a well-defined tool and that there are specific guidelines and procedures that should be followed to use it effectively.

Background

In 1939, an advertising executive by the name of Alex F. Osborn began organizing groups of people at his agency, Batten, Barton, Dustine & Osborn (BBDO), in an effort to be more creatively productive together. Osborn's early participants started referring to these meetings as "brainstorming sessions." Osborn claimed this was an apt name because "in this case, 'Brainstorm' means using the brain to storm a creative problem—and to do so in a commando fashion, with each stormer audaciously attacking the same objective" (Osborn, 1953).

Osborn continued his research on creativity, developing processes and tools to aid in the process and later, in 1953, Osborn wrote his book called *Applied Imagination: Principles and Procedures of Creative Thinking*, in which he "presents workable methods which utilize what is known about the creative imagination" (Osborn, 1953). *Applied Imagination* has become a classic for those interested in the subject of brainstorming and creativity (Isaksen, Dorval & Trefinger, 2011) and brainstorming has become one of the most popular and often utilized tools for idea generation in organizational settings, with corporate leaders believing that brainstorming will lead to more ideas generated and higher efficiency, quality, production, and enthusiasm (Rowatt, Nesselroade Jr., Beggan & Allison, 1997; Taylor, Berry & Block, 1958).

Guidelines

A great deal of the available research focuses on specific rules or guidelines to be used to increase the efficacy of brainstorming sessions.

In his book *Applied Imagination*, Osborn listed four rules to be faithfully followed to maximize results of a brainstorming session:

1. *Judicial judgment is ruled out*.

   Criticism of ideas must be withheld until later. "Premature judgment may douse our creative flames, and even wash away ideas already generated… Especially in approaching a creative problem, we should give imagination priority over judgment and let it roam around our objective" (Osborn, 1953 p.95).

2. *"Free-wheeling" is welcomed*.

   The wilder the idea, the better; it is easier to tame down than to think up. In regards to a quote from Oliver Cromwell stating that "No one rises so high as he who knows not whither he is going," Osborn believed that "this is largely true in the imaginative soaring which is called for when seeking to pile up hypotheses," and that "the more freely we swing our imagination, the more likely we are to enlist the help of Lady Luck in the form of so-called inspiration" (Osborn, 1953 p.153).

3. *Quantity is wanted.*

   The greater the number of ideas, the better the likelihood that there will be winners. The principle of the machine-gun is an apt parallel: "The odds are that but a few of the many ideas we hit upon will be any good, therefore, the

more alternatives we think up, the better our chance for success" (Osborn, 1953 p.154).

4. *Combination and improvement are sought.*

   In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into *better* ideas; or how two or more ideas can be joined into still another idea (Osborn, 1953 p.300; Rickards, 1999).

Osborn emphasized the value of group interaction in facilitating the flow of ideas and believed that when following his guidelines for brainstorming that "the average individual can think up twice as many ideas when working with a group than when working alone" (Osborn, 1953). Reitzschel et al. state that "group interaction offers the potential for cognitive stimulation: hearing another person's ideas may give rise to new ideas" (2007).

More recently, in their book *The Art of Innovation (2001)*, Kelly and Littman revise the rules and expand them to "Seven Secrets for better brainstorming":

1. *Sharpen the focus*.

   Good brainstormers start with a well-honed statement of the problem.

2. *Keep the Rules Playful.*

   Don't start to critique or debate ideas, keep the process light-hearted and enjoyable.

3. *Number your ideas.*

   Labeled solutions make it easier to reference later.

4. *Build and jump.*

   Expand on the ideas of others; don't be limited by one train of thought.

5. *The space remembers.*

   Great brainstorm leaders understand the power of spatial memory and how location can help one to unconsciously trigger thoughts and concepts.

6. *Stretch your mental muscles.*

   Start up with a warm up exercise, something simple and enjoyable to get into the right frame of mind.

7. *Get physical.*

   Good brainstorms are extremely visual. Participants include sketching, mind mapping, diagraming, and drawing stick figures to express ideas and concepts.

Osborn believed that the ideal size of a brainstorming group should be between five and 10 persons (Osborn, 1953 p.304). He did not feel that a random selection of participants was effective, but that good partnership and rapport within the group was important. “Most of us can work better creatively when teamed up with the right partner because collaboration tends to induce effort, and also spur our automatic power of association” (Osborn, 1953). Others, however, believe that when working on a creative task, or generating ideas on how to accomplish a goal, it is valuable to include many points of view. Byrne and Sands state: “Brainstorming participants draw on their diverse experiences, skills, and interests as they banter and build a tremendous variety of ways to get the job done” (2002, p.56). An ideal group would involve and include the widest spectrum of experience, diversity, and personalities that can effectively be managed (Bradley & Hebert, 1997; Isaksen, Dorval, and Trefinger, 2011 p.172). In their book

Creative Approaches to Problem Solving, Isaksen, Dorval, and Trefinger offer a list of attributes that they believe are important to consider when looking at a team:

1. How competent or skillful are they with specific creativity-related methods and tools;
2. How motivated are they to work on certain challenges;
3. What is the social and cultural setting in which they grew up and now live;
4. Who are the people that guided and inspired them throughout their lives;
5. What are their ages, genders, and interests; and
6. What are their preferred styles of creativity, decision-making, and problem solving (2002, p167).

They believe that creative behavior and problem solving "draw on skills, or applications of tools and procedures that people have learned and practiced, and requires motivation, or the engagement and passion to accomplish a task or meet a goal" (Isaksen, Dorval, and Trefinger, 2011 p.168).

It should be noted that Osborn did not believe it necessary to come to a solution in a single setting; in fact he believed that a multi-staged approach should be used. "To insure maximum creativity in teamwork, each collaborator should take time out for solitary meditation. By working together, then alone, then together, a pair is more likely to achieve the best creative thinking" (Osborn, 1953 p.293). "During certain periods in a creative quest, each member of a team should go off by himself and do some brainstorming on his own. When the partners come together after such solo thinking, they will find that they have piled up more worthwhile alternatives than if they had kept on collaborating *all* the time" (Osborn, 1953 p.294).

Barriers to Effective Brainstorming

Osborn believed that one of the main obstacles to successfully solving problems creatively "is our tendency to limit our own productivity, both through premature criticism and a lack of persistence" (Rietzschel, Nijstad & Stroebe, 2007). Studies have found and described a number of challenges that can limit the productivity of brainstorming groups; some of the most often cited examples are listed below.

Production Blocking

Production blocking refers to when group members must take turns to express their ideas and are unable to express their ideas at the time they choose. It has been shown that when individual members must wait their turn to express their ideas soon after they are generated, "productivity strongly declines" (Nijstad & Stroebe, 2006; Diehl & Stroebe, 1987; Isaksen & Gaulin, 2005). In a group setting speaking time is a shared commodity, and individual members may not have enough available time to adequately voice their ideas. Additionally, participants may forget their ideas while they wait for their turn or may decide that the idea is no longer relevant (Paulus, Larey & Dzindolet, 2001). Ultimately, one of the main contributing factors to production blocking is a lack of procedures that allow for and encourage simultaneous processing (Isaksen & Gaulin, 2005).

Evaluation Apprehension

Despite explicit instruction not to criticize ideas, individuals still get anxious about sharing their ideas with the group and even though there may not be any obvious reactions to shared ideas, individuals may still be worried about the private reactions of others within the group (Nijstad & Stroebe, 2006; Paulus, 2000). It has been stated that, "the productivity of brainstorming groups may be inhibited by fear of critical evaluation and the participants' desire to go along with the dominant pattern of idea generation" (Isaksen & Gaulin, 2005, p316). "Fear of being judged and pressure to stay within the bounds of existing options clearly have an inhibiting effect on the performance of groups when their task is generating many, varied, and unusual ideas" (Isaksen & Gaulin, 2005, p316). Lamm & Trommsdorff speculate, "it would be interesting to investigate whether alcohol can be shown to decrease the social caution (inhibition) presumably preventing group members from voicing 'risky' ideas" (1972).

Free Riding or Social Loafing

Free riding is the tendency of group members to let others do the majority of the work because one cannot be individually held accountable for their performance within the group and the perception of decreased influence within the group (Nijstad & Stroebe, 2006; Diehl & Stroebe, 1987). It is possible that "a few individuals (especially those who are more extroverted or verbal in their personality or style) can take over the group or dominate the group's efforts. Sometimes, they may not even be aware that certain members of the group are holding back or are not contributing their thoughts" (Isaksen, Dorval, and Trefinger, 2011, pg.92).

Social Matching

Social matching is what happens when high-performing group members tend to match the rate of idea production of lower-performing members (Nijstad & Stroebe, 2006; Paulus, Larey & Dzindolet, 2001).

Additional Concerns

Kelly and Littman (2001) believe that a brainstorming session is a terrible thing to waste and that it's easy to do improperly. They list six surefire ways to kill a brainstormer:

1. *The boss gets to speak first.*

   Knowingly or unknowingly, the authority figure sets the tone and direction of the discussion.

2. *Everybody gets a turn.*

   Insisting that everyone contribute in orderly fashion kill spontaneity and contributes to production blocking.

3. *Experts only please.*

   The most knowledgeable people have the most pre-conceived notions and blind spots to opportunity.

4. *Do it off-site.*

   Creativity and inspiration should be a regular occurrence inside the office, not just under special circumstances that can *only* happen as a deliberately planned event.

5. *No silly stuff.*

   Brainstorming should be an exciting and enjoyable experience rather than an odious task.

6. *Write down everything.*

   Taking notes shifts focus to the wrong side of the brain. Sketch, draw, or doodle; this needs to be creativity in action and not history 101 (Kelly, & Littman, 2001 pp.64-66).

"A brainstorm can feel like its just another meeting, or it can be a fun, invigorating experience that can take a project or a team to a new level" (Kelly, & Littman, 2001 p.66). It has been suggested that the term *brainstorming* has evolved (or devolved) into something that describes meetings whose form has deviated significantly from the originally intended procedures (Rickards, 1999). Kelly and Littman state, "The problem with brainstorming is that everyone *thinks* they already do it… In fact, more than 70 percent of the businesspeople in a recent Arthur Anderson survey say they use brainstorming in their organizations" (2001 p.55).

Efficacy of Brainstorming

Real Efficacy

Ever since Osborn's book *Applied Imagination* (1953), many consider group brainstorming to be a particularly effective technique for generating large quantities of ideas, yielding more than with individual (or nominal group) brainstorming (Rietzchel et al, 2006), and there have been many studies that focus on the question of whether

individuals or groups are more productive when brainstorming (Diehl & Strobe, 1991; Nickerson, 1999; Rickards, 1999). In fact, Diehl and Stroebe (1987) state, "nominal groups generated significantly more ideas than real groups in 18 out of 22 studies published between 1958 and 1984."

"Brainstorming is not necessarily the ultimate technique for idea generation, and it cannot be built into the structure of every organization. But it does prove its worth when the goal is to open up a broad spectrum of ideas. Other approaches are important for *making* choices, but nothing beats a good brainstorming session for *creating* them" (Brown, 2009 p.79).

Perception of Efficacy

Research has shown, in spite of perceptions to the contrary, that within a group setting there is a much lower level of productivity in terms of both quality and quantity than with an individual working alone (Diehl & Stroebe, 1987; Stroebe, Diehl & Abakoumkin, 1992). Even so, most people believe group interactions to be quite effective, and there continues to be the perception that people generate more ideas in a group than they do individually (Paulus, 2000; Stroebe, Diehl & Abakoumkin, 1992). In addition to the positive feelings about the group brainstorming sessions, group members tend to view their performance more favorably than when working alone. "Individuals in groups report generally positive feelings and enjoyment of the group experience" (Paulus, Larey & Dzindolet, 2001). Generally, participants tend to have a positive bias toward group sessions and when comparing those subjects that worked individually and those that worked in groups, group participants were more likely to report enjoying the

brainstorming session and being satisfied with their performance (Paulus, Larey & Dzindolet, 2001; Stroebe, Diehl & Abakoumkin, 1992). These feelings of efficacy and enjoyment have been referred to the "illusion of group effectivity" (Stroebe, Diehl & Abakoumkin, 1992). In fact, in their 1987 study, Diehl and Stroebe found that "when asked at the end of either a group or an individual brainstorming session who would produce more ideas, someone working alone or a person who works in a group, 80% of the subjects indicated that a person in a group would be more productive." Additionally, "Subjects who worked individually believed that they would have had many more ideas if they had been in a group, whereas group members did not believe that they would have done better individually (Stroebe, Diehl & Abakoumkin, 1992).

Theory of Psychological Types

In 1920, Carl G. Jung, a Swiss psychiatrist, suggested that "people are different in fundamental ways even though they all have the same multitude of instincts (archetypes) to drive them from within," and that "one instinct is no more important than another." He felt that what was important is "our preference for how we 'function'." Through this line of thinking, Jung developed "Psychological Types" (Keirsey, and Bates, 1984, p.3).

Jung's interest in types derived from his observations of consistent differences in people that could not be attributed to their psychopathology. The first of these differences he found were those of the extrovert and introvert attitude types. Extroversion and introversion can be explained as two opposite ways of feeling energized and using your own energy and resources, as well as the energy and resources of others around you. Everyone uses both extraversion and introversion to some extent, but has a preferred

method of interacting with the world (Jung, 1924, p.542, 567; Keirsey, and Bates, 1984, p.14; Murray, 2000 p.1189; Quenk, 2000 p.59).

Extroverts tend to direct energy outwards into the world, they feel more energized when actively involved in the external world around them. An extrovert draws energy when interacting with people and events, when they are able to discuss possibilities and build on the ideas of others. The extrovert is not bothered by noise and external stimulation, and prefers action to reflection when solving a problem (Bradley & Herbert, 1997; Isaksen, Dorval, and Trefinger, 2011 p.172).

Introverts, on the other hand, direct focus inwards, drawing energy from within, reflecting before taking action. They will first consider their ideas and options before sharing them with others, and take action only after careful contemplation. An introvert will tend to prefer quiet reflection and taking time to process information at their own pace (Bradley & Herbert, 1997; Isaksen, Dorval, and Trefinger, 2011 p.172).

Meyers-Briggs Type Indicator

Based on and grounded in the theory of C.G.Jung's theory of psychological types, first presented in his book *Psychological Types* (1921), the Meyers-Briggs Type Indicator (MBTI) personality inventory was devised as an instrument by Katherine C. Briggs and her daughter Isabel Briggs Myers. The MBTI was intended to be an inventory of basic preferences rather than a measure of individual personality traits (Bradley & Hebert, 1997; Murray, 2000; Isaksen, Lauer & Wilson, 2003). The MBTI has been described as "a nonthreatening vehicle to introduce the concept of individual differences in personality and the relation between personality constructs and behavior to a general audience"

(Pittenger 2005). The MBTI has become by far the most widely used instrument for assessing normal personality functioning, has been extensively tested for validity and reliability, and has become the most widely used instrument in business and for non-psychiatric populations (Bradley & Hebert, 1997; Murray, 1990; Quenk, 2000).

The MBTI was designed to be a forced-choice self-report inventory that generates scores that describe the interactions within four sets of polar opposite pairs.

1. *Extraversion (E) or Introversion (I)*—where you focus your attention and get energy, either externally in the world or internally within oneself.
2. *Sensing (S) or Intuition (N)*—how you perceive and take in information, becoming aware of sensory information versus abstract pattern information and meanings.
3. *Thinking (T) or Feeling (F)*—how you make decisions, detached and objective, or based on subjective considerations and a personal or universal set of values.
4. *Judging (J) or Perceiving (P)*—how you deal with the outer world, in an orderly and structured fashion, or unstructured and open-ended (Berens, 1998; Bradley & Hebert, 1997; Isaksen, Lauer & Wilson, 2003; Schaubhut, Herk, & Thompson, 2009)

The *MBTI Form M Manual Supplement* reports, "The MBTI's validity has been established in a number of ways." First, with correlation between the MBTI assessment and six other personality assessments, showing expected relationships between the various instruments. Next, results of best-fit type analyses have been shown to be similar to results from previous research with high rates of agreement between reported and best-

fit types. Finally, “with factor analysis showing the expected four-factor structure of the assessment” (Schaubhut, Herk, & Thompson, 2009).

In spite of all the accolades received, it has been cautioned that the four-letter type formula may be an oversimplification, leaving the recipient with “a false impression that there is little left to doubt” of complex personality dynamics (Pittenger 2005).

Existing literature suggests that personality type can play a significant role in the success of team performance (Bradley & Hebert, 1997; Reilly, Lynn, & Aaronson, 2002). Bradley and Hebert believe each personality type “has a positive contribution to make to the overall effectiveness of the team, therefore a balance of personality types should be sought” and suggesting “extroverts help open lines of communication between group members, while introverts provide internal reflection of group discussions” (1997).

Chapter 3

RESEARCH DESIGN

Recruitment

Participants for this study were selected from a pool of volunteers enrolled in Arizona State University's GRA440 Finding Purpose class, taught by Professor William Heywood in the fall semester of 2011. Potential participants would have already taken the Meyers-Briggs Type Inventory assessment as part of their coursework in Professor Heywood's class, and would have knowledge of their personality regarding introvert and extrovert types. During a class session prior to the brainstorming study, Professor Heywood informed the students of the nature of the study and asked for volunteers to assist by way of participation in one of two sessions at a date to be determined, and to follow immediately after their Finding Purpose class. Once the desired number of participants had been reached (ideally 10 participants per session, made up of 5 introverts and 5 extroverts), a room was scheduled and the volunteers were contacted with the information regarding time and date for the study.

Study Proceedings

Introduction and Session Kickoff:

Participants were thanked for volunteering for the project, instructed to collect a Sharpie pen and a stack of colored Post-It Notes to be used for the entire session (there was enough variation available for each participant to have a unique color of Post-It Notes), and then asked to read, sign, and date a copy of the "Consent Form – Individual

and Nominal Group Brainstorming." They were then told which of two formats they would be following for the evening: either starting with an individual session first then moving into a group session, or a starting together as a group session leading then into an individual session.

Introduction to The Rules of Brainstorming

The following rules of brainstorming were displayed by way of a PowerPoint slide and explained by the researcher:

1. Judicial judgment is ruled out. Criticism of ideas must be withheld until later.
2. "Free-wheeling is welcomed. The wilder the idea, the better; it is easier to tame down than to think up."
3. Quantity is wanted. The greater number of ideas, the more likelihood of winners.
4. Combination and improvement are sought. In addition to contributing ideas of their own, participants should suggest how ideas of others can be turned into better ideas; or how two or more ideas can be combined into still another idea.

Individual Brainstorming Session

Explanation of Individual Brainstorming Process:

Each participant was given pens and Post-It Notes with which to write down as many ideas as possible within a 10-minute timeframe.

On the walls of the room were numbered (1-10) and dated sheets of 18x24 paper for each individual participant to stick brainstorming idea Post-It Notes on as they were generated.

Participants were encouraged to use just a few words or simple sentences for their ideas – "now is the time to generate a LOT of ideas, refining and explaining would come at a later time."

If they ran out of space on their sheet of paper, they were instructed to fill up nearby wall space as well.

Introduction of Problem:

Once the participants were situated in front of a piece of paper with their Post-It Notes and Sharpie markers, they were introduced to the brainstorming topic for the evening. The question to be addressed was "How to improve airline travel."
This could have included ANY aspect of airline travel; from the moment of entry at the departure airport to the moment of exit at the arrival airport. Participants were encouraged not to limit themselves to just the plane itself.

Individual Brainstorming Session:

Participants were given ten minutes to generate as many ideas as possible, writing them down on the provided Post-It Notes and then placing the Post-It Note on their selected sheet of paper attached to the wall. A one-minute warning was given, and at the end of the ten-minute session participants were instructed to finish writing down their last idea and step away from their work.

Individual Post-Session Questionnaire:

Following the brainstorming session, participants were invited to take 5 minutes to fill out an individual Post-Session Questionnaire and take a quick break. The surveys were to be noted with the same number as was present on the sheet of paper attached to the wall used by the participant as well as one of their colored Post-It Notes and a mark from the colored Sharpie used. This color-coding and numbering system would later be used to correlate each individual's data from the session. Responses to questionnaire statements in regards to satisfaction were determined on a five-point Likert-type scale of Agree / Somewhat Agree / Neutral / Somewhat Disagree / Disagree. The questions on the individual post-session questionnaire were comprised of:

1. I am satisfied with my role in the brainstorming session.
2. I am satisfied with the results of the brainstorming session.
3. The brainstorming session was successful.
4. The brainstorming session generated a sufficient number of ideas.
5. I enjoyed actively participating on my own behalf during the brainstorming session.
6. I enjoyed working independently during the brainstorming session.
7. I am satisfied with the structure of the brainstorming session.
8. The structure of the session allowed me to contribute all the ideas I wished to contribute.
9. The structure of the session facilitated the flow of ideas.
10. I enjoyed participating in this individual brainstorming session.

Group Brainstorming Session

Explanation of Group Brainstorming Process:

The group as a whole was again given 10 minutes with which to use the same colored pens and Post-It Notes used previously in the individual session to generate as many of their own ideas as possible in addition to building off of the ideas of others. They were invited as an entire group to the front of the room and instructed to, in the process of generating ideas, say each idea out loud for the group to hear, write down the idea on their post-it, and then post the note to the community whiteboard for others to see. Participants were encouraged to use just a few words or simple sentences for their ideas – "now is the time to generate a LOT of ideas, refining and explaining would come at a later time." A one-minute warning was given, and at the end of the ten-minute session participants were instructed to finish writing down their last idea and step away from their work and gather back at the center of the room.

Group Post-Session Questionnaire:

Following the brainstorming session, participants were invited to take 5 minutes to fill out a Group Post-Session Questionnaire. The surveys were to be noted with the same number as was present on the sheet of paper attached to the wall used by the participant as well as one of their colored Post-It Notes and a mark from the colored Sharpie used. This color-coding and numbering system would later be used to correlate each individual's data from the session. Responses to questionnaire statements in regards to satisfaction were determined on a five-point Likert-type scale of Agree / Somewhat

Agree / Neutral / Somewhat Disagree / Disagree. The questions on the individual post-session questionnaire were comprised of:

1. Prior to this study, have you participated in a group brainstorming session?
   Yes / No
2. How much time, before this study, have you spent in brainstorming sessions?
   0-2 hours 2-4 hours 4-6 hours 6-8 hours 8-10 hours 10+ hours
3. In what environments have you used brainstorming? (Circle all that apply)
   Business Personal Educational
4. I am satisfied with my role in the brainstorming session.
5. I am satisfied with the results of the brainstorming session.
6. The brainstorming session was successful.
7. The brainstorming session generated a sufficient number of ideas.
8. I enjoyed actively participating on my own behalf during the brainstorming session.
9. I enjoyed being a part of the group during the brainstorming session.
10. I am satisfied with the structure of the brainstorming session.
11. Each member participated equally.
12. The structure of the session allowed me to contribute all the ideas I wished to contribute.
13. The structure of the session facilitated the flow of ideas.
14. Each participant was provided enough opportunity to participate in the group brainstorm.
15. Some participants contributed more than others in the group.

16. I am satisfied with the facilitation (role of the facilitator) in the Brainstorming session.
17. I would enjoy participating in additional group brainstorming sessions like this past session.

End of Session

Participants were thanked for their time and participation and were welcome to leave after finishing their final survey.

Chapter 4

ANALYSIS OF DATA

General Background Questions

Question 1: Prior to this study, have you participated in a group brainstorming session?

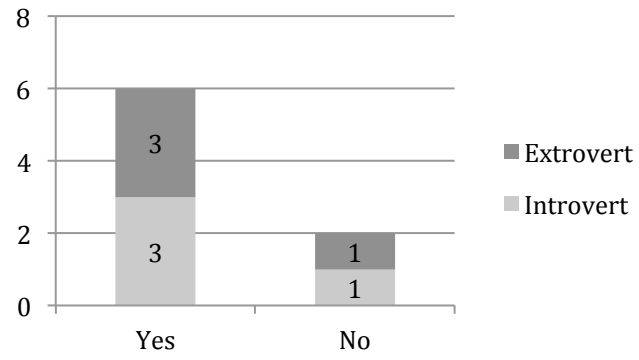

Figure 2. Response to Question 1 (G-I Sequence)

6 of 8 participants (75%) had previously participated in a group brainstorming session prior to this study.

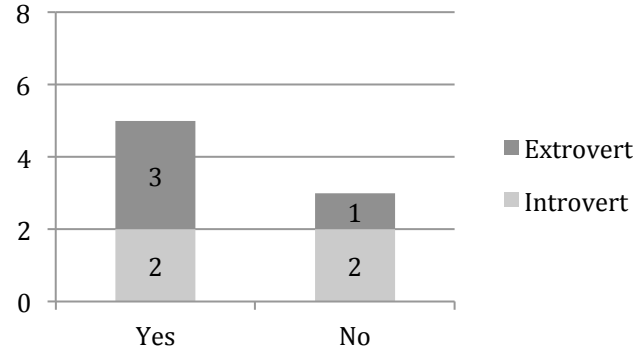

Figure 3. Response to Question 1 (I-G Sequence)

5 of 8 participants (62.5%) had previously participated in a group brainstorming session prior to this study.

Question 2: How much time, before this study, have you spent in brainstorming sessions?

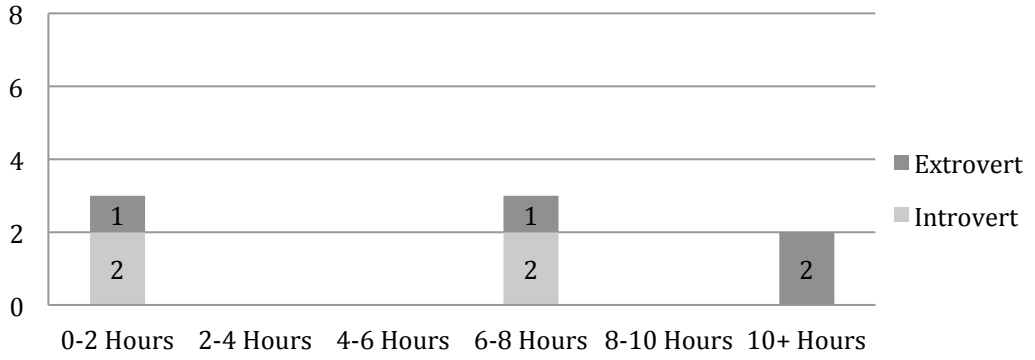

Figure 4. Response to Question 2 (G-I Sequence)

3 of 8 participants (37.5%) had spent 0-2 hours in brainstorming sessions, 3 of 8 participants (37.5%) had spent 6-8 hours in brainstorming sessions, and 2 of 8 (25%) participants had spent 10+ hours in brainstorming sessions.

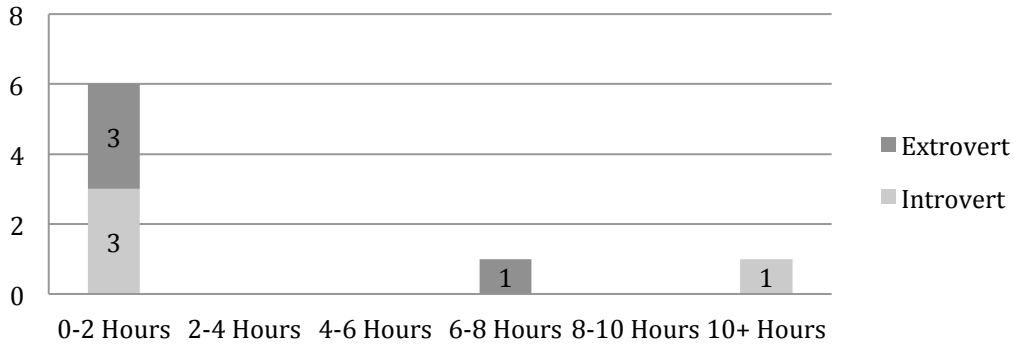

Figure 5. Response to Question 2 (I-G Sequence)

6 of 8 participants (75%) had spent 0-2 hours in brainstorming sessions, 1 of 8 (12.5%) participants had spent 6-8 hours in brainstorming sessions, and 1 of 8 (12.5%) participants had spent 10+ hours in brainstorming sessions.

Question 3: In what environments have you used brainstorming? (circle all that apply)

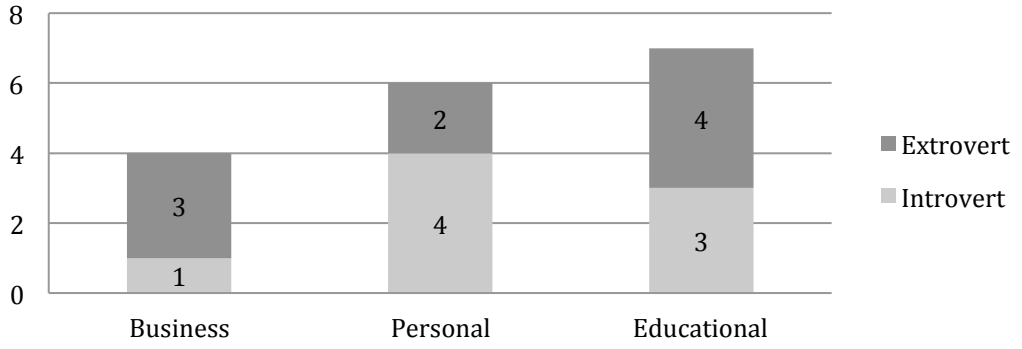

Figure 6. Response to Question 3 (G-I Sequence)

4 of 8 (60%) participants used brainstorming in a business environment, 6 of 8 (75%) participants used brainstorming in a personal environment, and 7 of 8 (87.5%) participants used brainstorming in an educational environment.

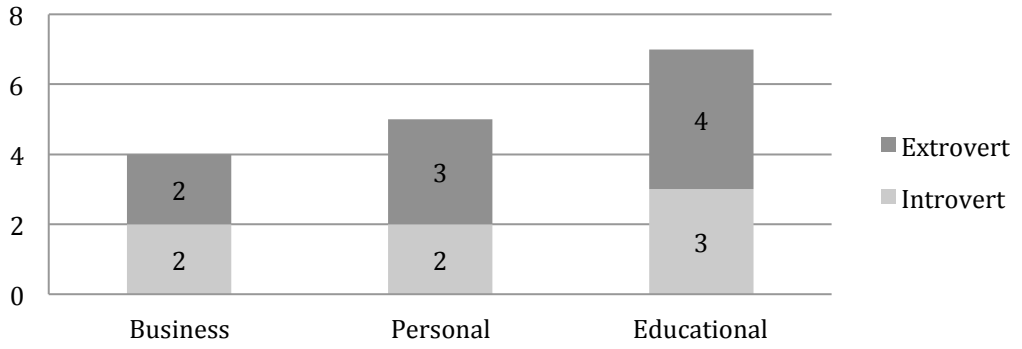

Figure 7. Response to Question 3 (I-G Sequence)

4 of 8 (50%) participants used brainstorming in a business environment, 5 of 8 (62.5%) participants used brainstorming in a personal environment, and 7 of 8 (87.5%) participants used brainstorming in an educational environment.

Statement 1: The brainstorming session was successful.

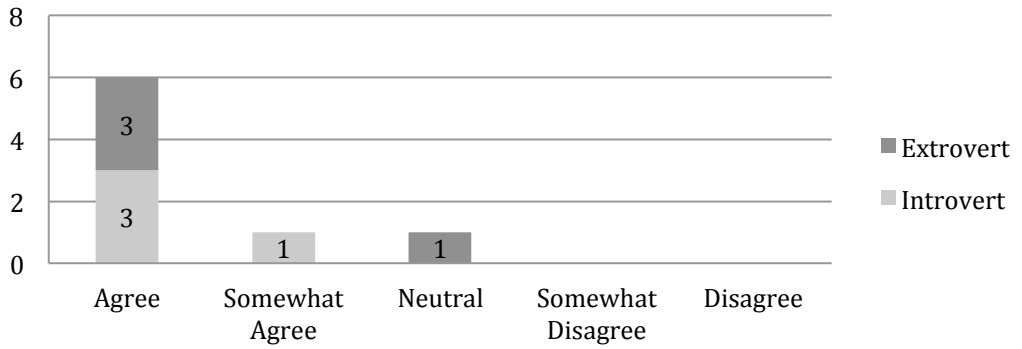

Figure 8. Response to Statement 1 (G-I Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) Somewhat Agreed, and 1(12.5%) was Neutral with the statement "The brainstorming session was successful."

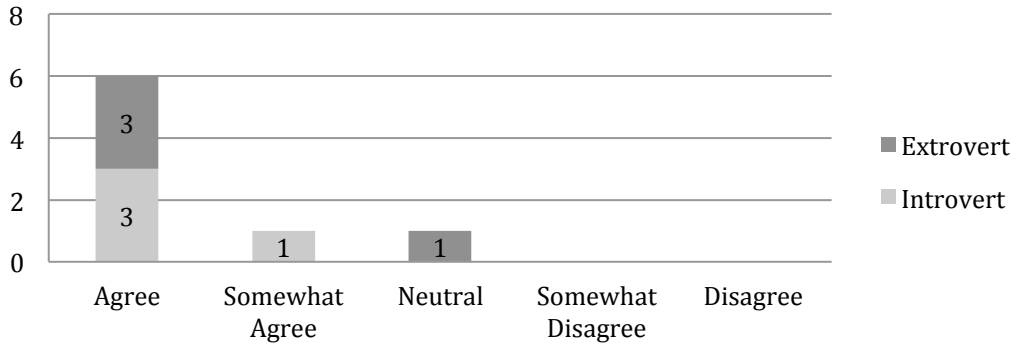

Figure 9. Response to Statement 1 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) Somewhat Agreed, and 1 (12.5%) was Neutral with the statement "The brainstorming session was successful."

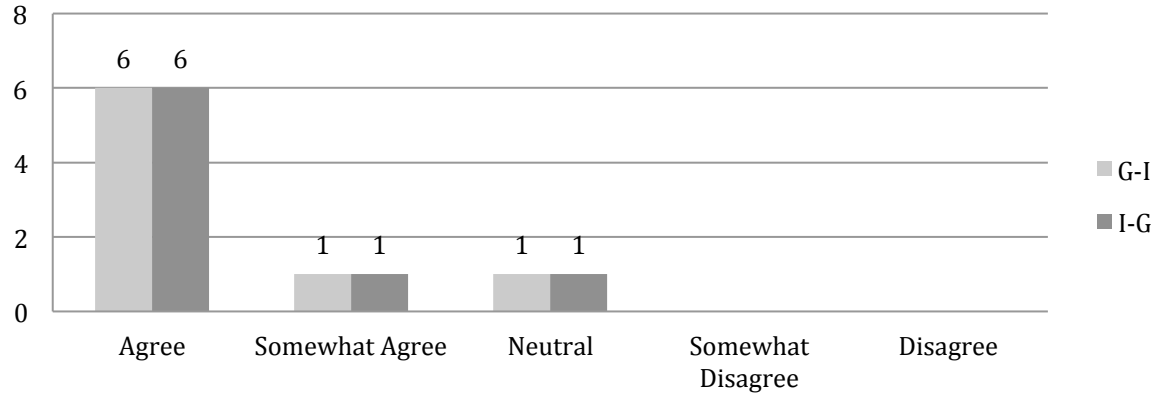

Figure 10. Response to Statement 1 (Sequence comparison)

Of the 16 participants, 12 (75%) Agreed, 2 (12.5%) Somewhat Agreed, and 2 (12.5%) were Neutral with the statement "The brainstorming session was successful."

Statement 2. The brainstorming session generated a sufficient number of ideas.

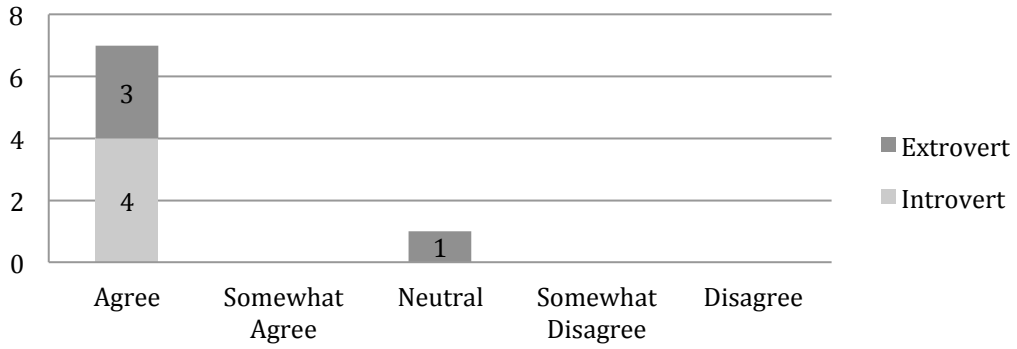

Figure 11. Response to Statement 2 (G-I Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) was Neutral with the statement "The brainstorming session generated a sufficient number of ideas."

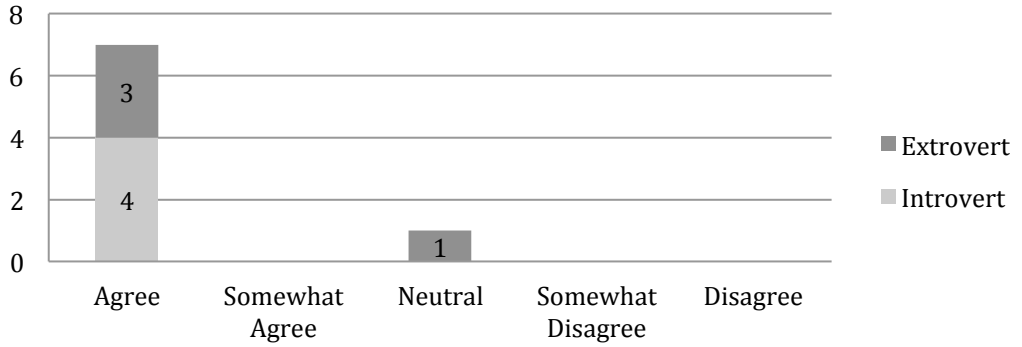

Figure 12. Response to Statement 2 (I-G Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) was Neutral with the statement "The brainstorming session generated a sufficient number of ideas."

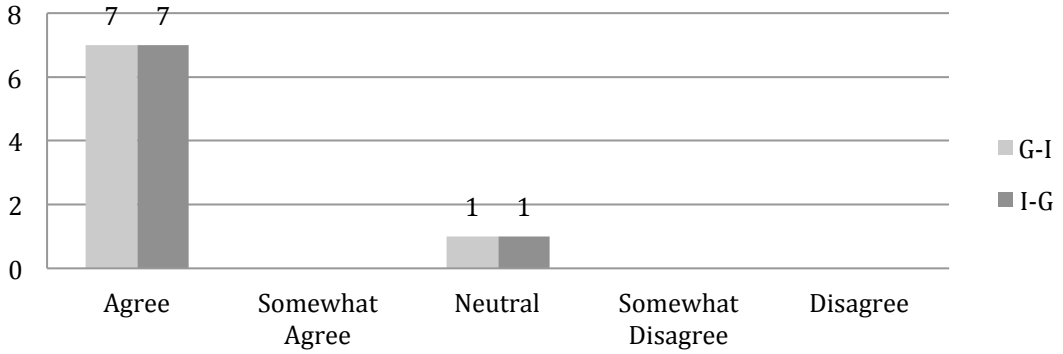

Figure 13. Response to Statement 2 (Sequence comparison)

Of the 16 participants, 14 (87.5%) Agreed and 2 (12.5%) were Neutral with the statement "The brainstorming session generated a sufficient number of ideas."

Statement 3. The structure of the session allowed me to contribute all the ideas I wished to contribute.

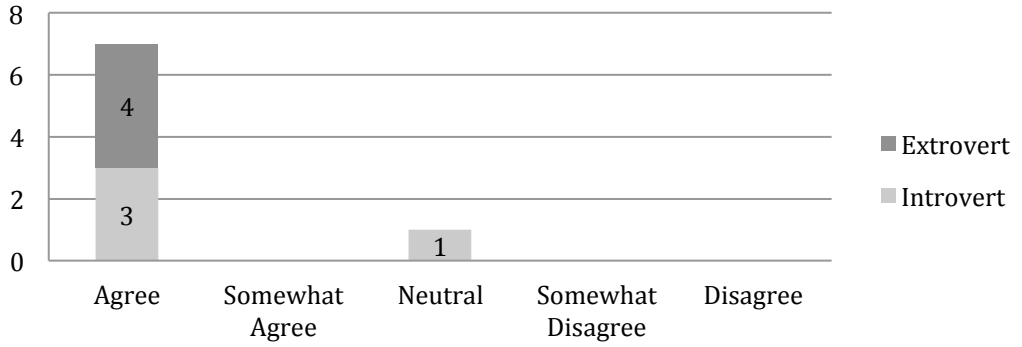

Figure 14. Response to Statement 3 (I-G Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 was Neutral (12.5%) with the statement "The structure of the session allowed me to contribute all the ideas I wished to contribute."

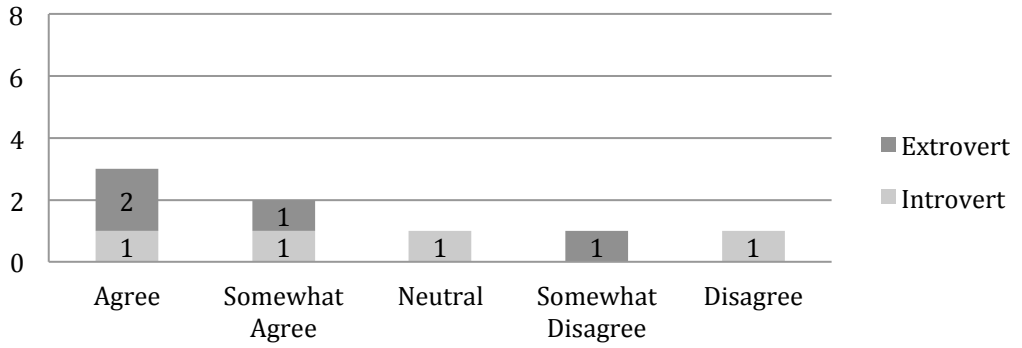

Figure 15. Response to Statement 3 (I-G Sequence)

Of the 8 participants, 3 (37.5%) Agreed, 1 (12.5%) Somewhat Agreed, 1 was Neutral (12.5%), 1 (12.5%) Somewhat Disagreed, and 1 (12.5%) Disagreed with the statement "The structure of the session allowed me to contribute all the ideas I wished to contribute."

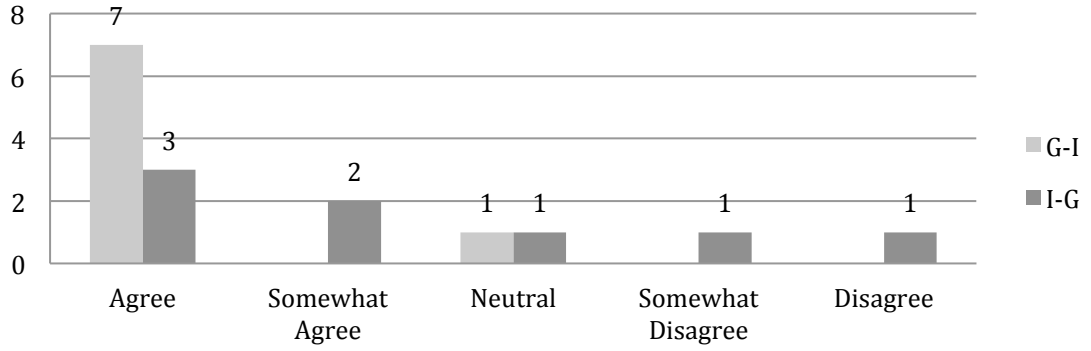

Figure 16. Response to Statement 3 (Sequence comparison)

Of the 16 participants, 10 (62.5%) Agreed, 2 (12.5%) Somewhat Agreed, 2 (12.5%) were Neutral, 1 (6.25%) Somewhat Disagreed, and 1 (6.25%) Disagreed with the statement "The structure of the session allowed me to contribute all the ideas I wished to contribute."

Statement 4. The structure of the session facilitated the flow of ideas.

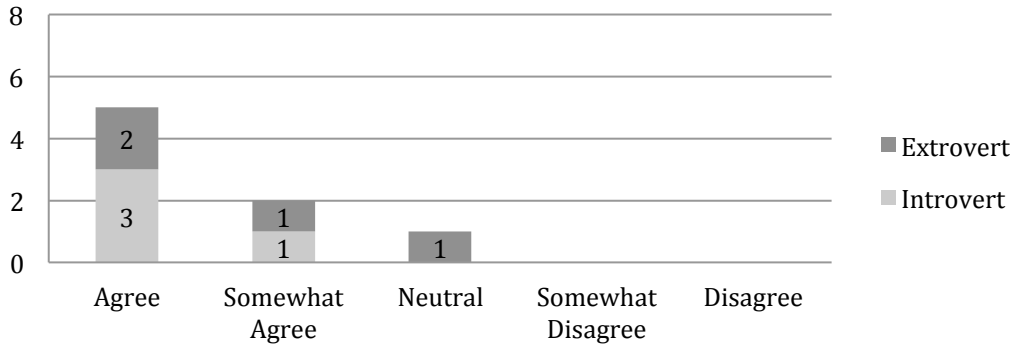

Figure 17. Response to Statement 4 (G-I Sequence)

Of the 8 participants, 5 (62.5%) Agreed, 2 (25%) Somewhat Agreed, and 1 (12.5%) was Neutral with the statement "The structure of the session facilitated the flow of ideas."

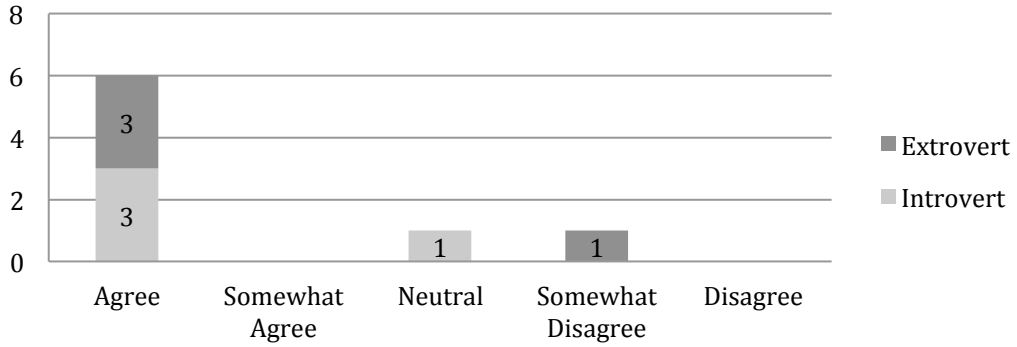

Figure 18. Response to Statement 4 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) were Neutral, and 1 (12.5%) Somewhat Disagreed with the statement "The structure of the session facilitated the flow of ideas."

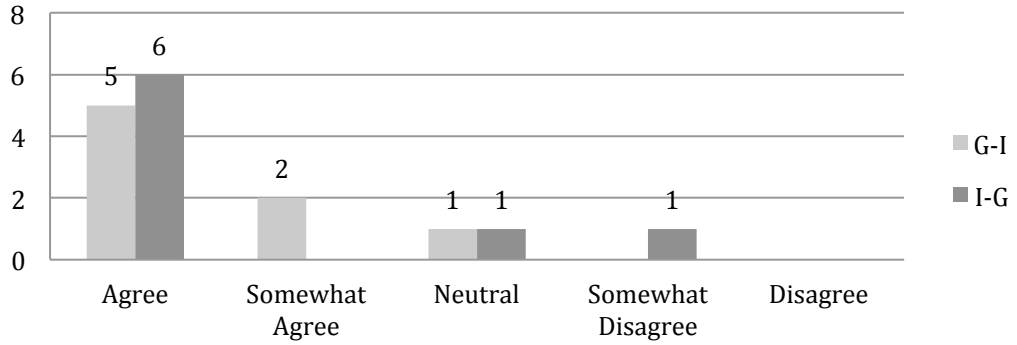

Figure 19. Response to Statement 4 (Sequence comparison)

Of the 16 participants, 11 (62.5%) Agreed, 2 (12.5%) Somewhat Agreed, 2 (12.5%) were Neutral, and 1 (6.25%) Somewhat Disagreed with the statement "The structure of the session facilitated the flow of ideas."

Statement 5. Each participant was provided with enough opportunity to participate in the group brainstorm.

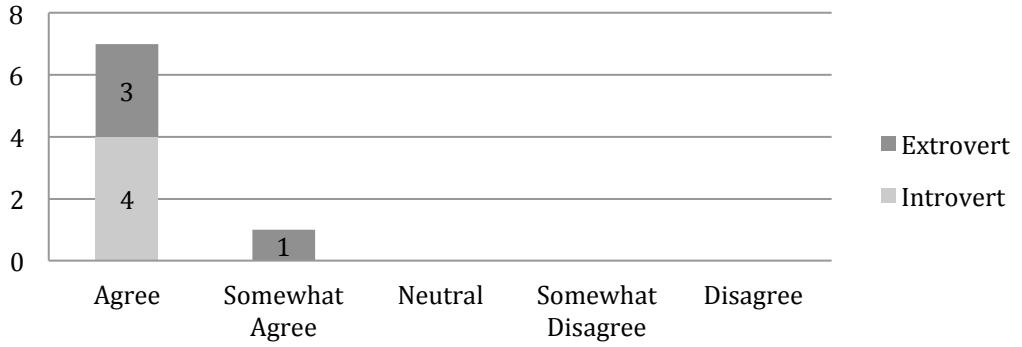

Figure 20. Response to Statement 5 (G-I Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) Somewhat Agreed with the statement "Each participant was provided with enough opportunity to participate in the group brainstorm."

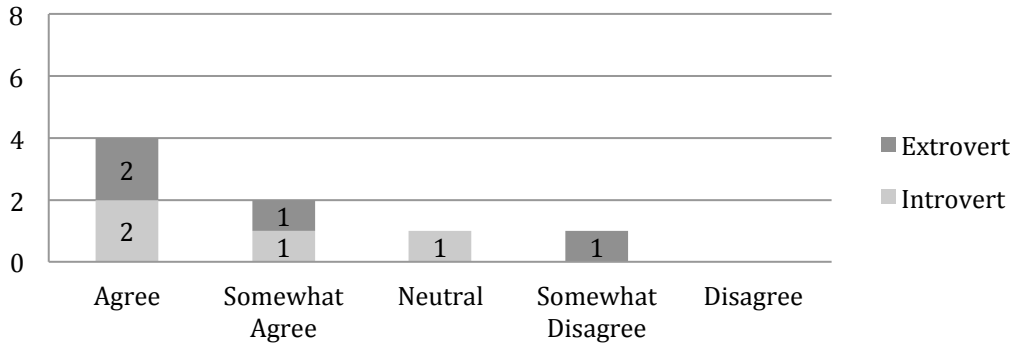

Figure 21. Response to Statement 5 (I-G Sequence)

Of the 8 participants, 4 (50%) Agreed, 2 (25%) Somewhat Agreed, 1 (12.5%) was Neutral, and 1 (12.5%) Somewhat Disagreed with the statement "Each participant was provided with enough opportunity to participate in the group brainstorm."

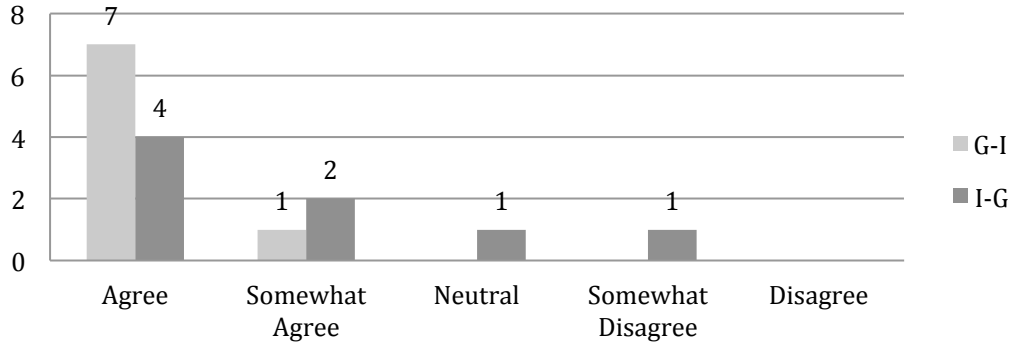

Figure 22. Response to Statement 5 (Sequence comparison)

Of the 16 participants, 11 (68.75%) Agreed, 3 (18.75%) Somewhat Agreed, 1 (6.25%) was Neutral, and 1 (6.25%) Somewhat Disagreed with the statement "Each participant was provided with enough opportunity to participate in the group brainstorm."

Statement 6. Some participants contributed more than others in the group.

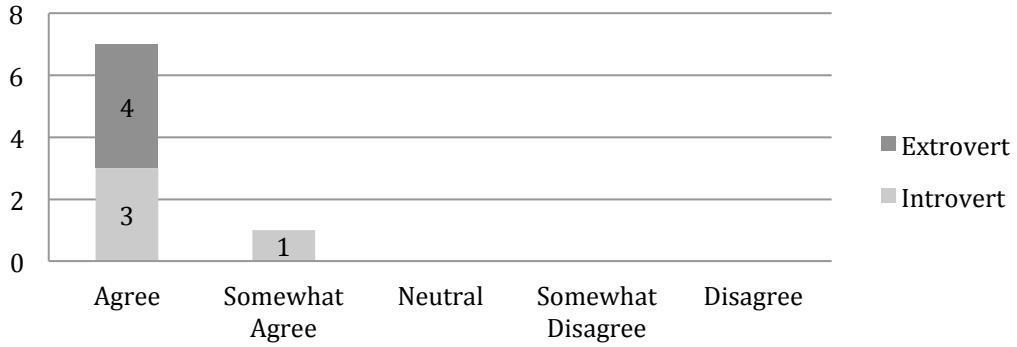

Figure 23. Response to Statement 6 (G-I Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) Somewhat Agreed with the statement "Some participants contributed more than others in the group."

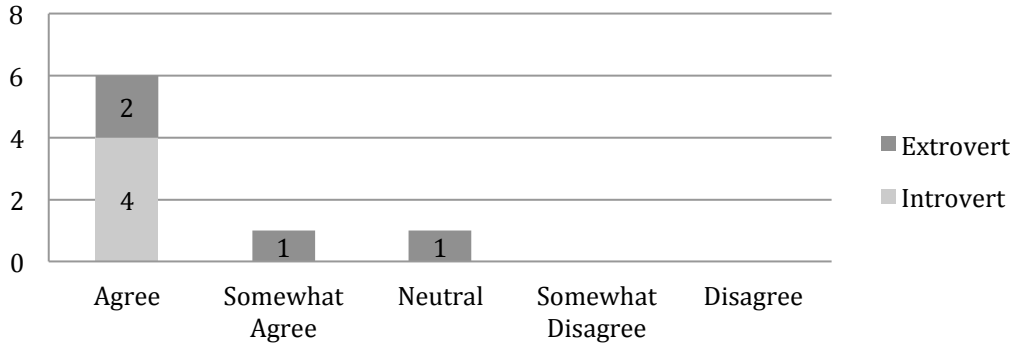

Figure 24. Response to Statement 6 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) Somewhat Agreed, and 1 (12.5%) was Neutral with the statement "Some participants contributed more than others in the group."

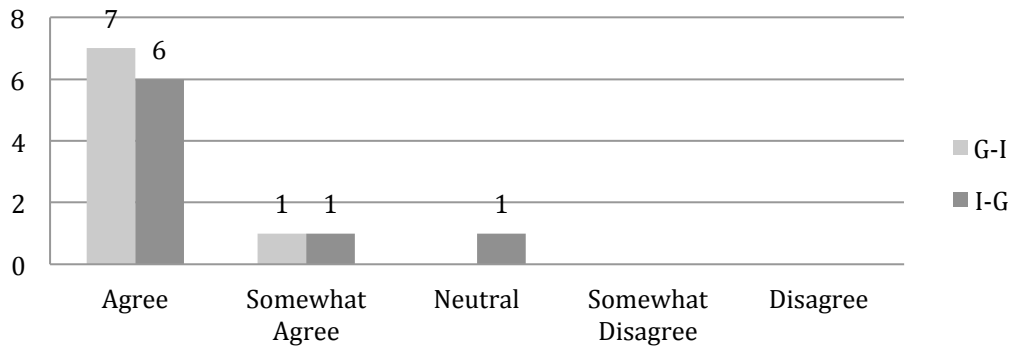

Figure 25. Response to Statement 6 (Sequence comparison)

Of the 16 participants, 13 (81.25%) Agreed, 2 (12.5%) Somewhat Agreed, and 1 (6.25%) was Neutral with the statement "Some participants contributed more than others in the group."

Statement 7. I am satisfied with my role in the brainstorming session.

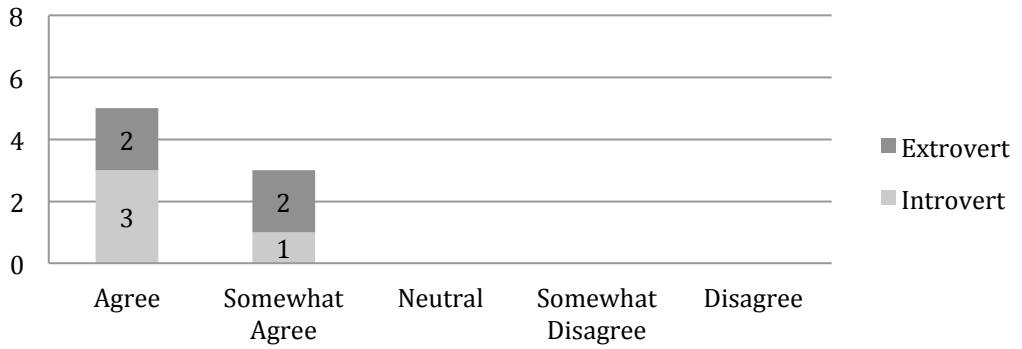

Figure 26. Response to Statement 7 (G-I Sequence)

Of the 8 participants, 5 (62.5%) Agreed, and 3 (12.5%) Somewhat Agreed with the statement "I am satisfied with my role in the brainstorming session."

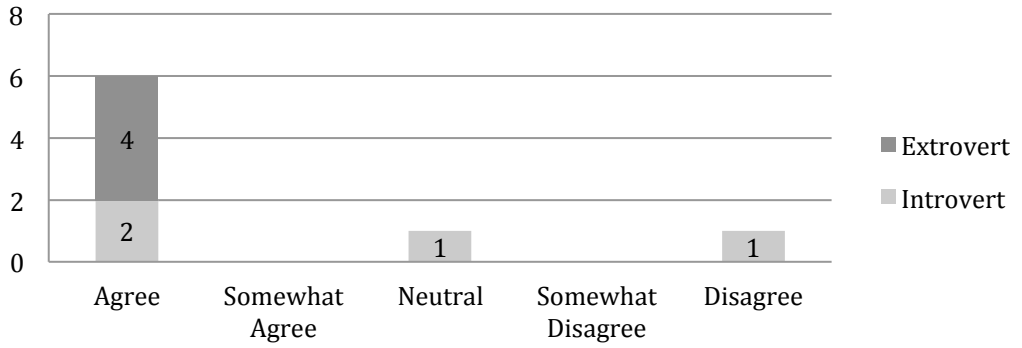

Figure 27. Response to Statement 7 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) was Neutral, and 1 (12.5%) Disagreed with the statement "I am satisfied with my role in the brainstorming session."

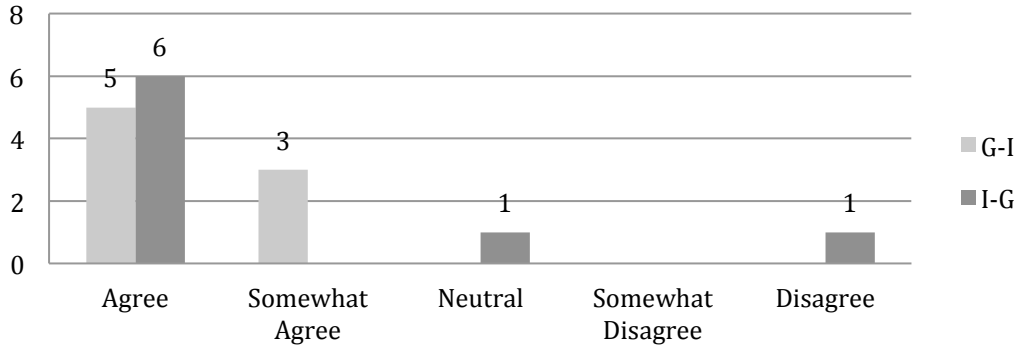

Figure 28. Response to Statement 7 (Sequence comparison)

Of the 16 participants, 11 (68.75%) Agreed, 3 (18.75%) Somewhat Agreed, 1 (6.25%) was Neutral, and 1 (6.25%) Disagreed with the statement "I am satisfied with my role in the brainstorming session."

Statement 8. I am satisfied with the results of the brainstorming session.

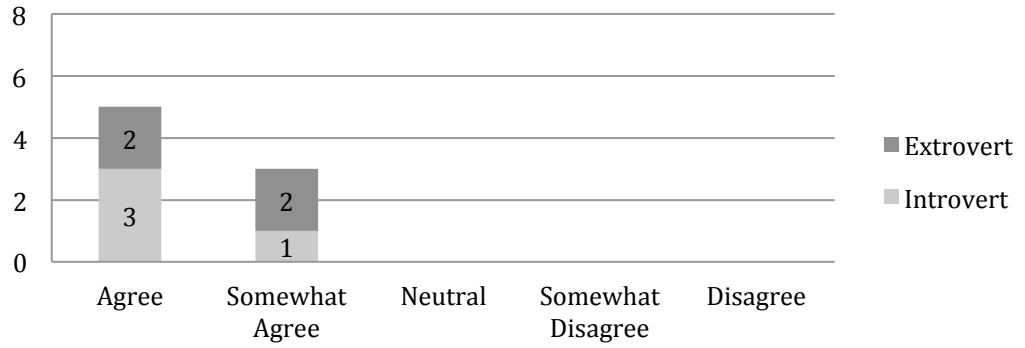

Figure 29. Response to Statement 8 (G-I Sequence)

Of the 8 participants, 5 (62.5%) Agreed, and 3 (37.5%) Somewhat Agreed with the statement "I am satisfied with the results of the brainstorming session."

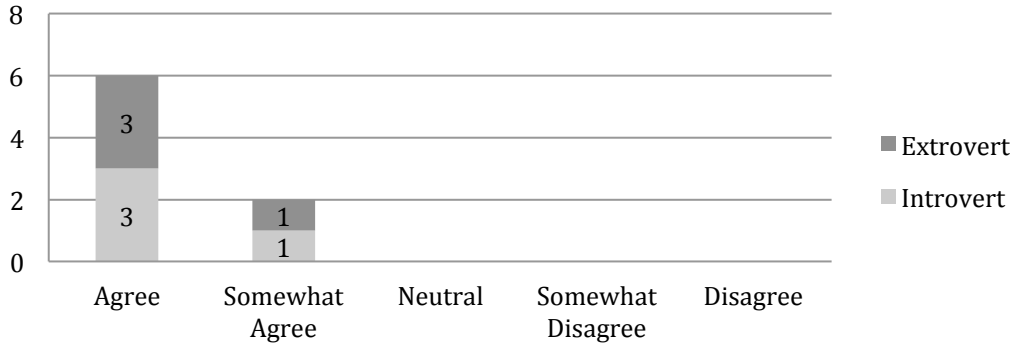

Figure 30. Response to Statement 8 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, and 2 (25%) Somewhat Agreed with the statement "I am satisfied with the results of the brainstorming session."

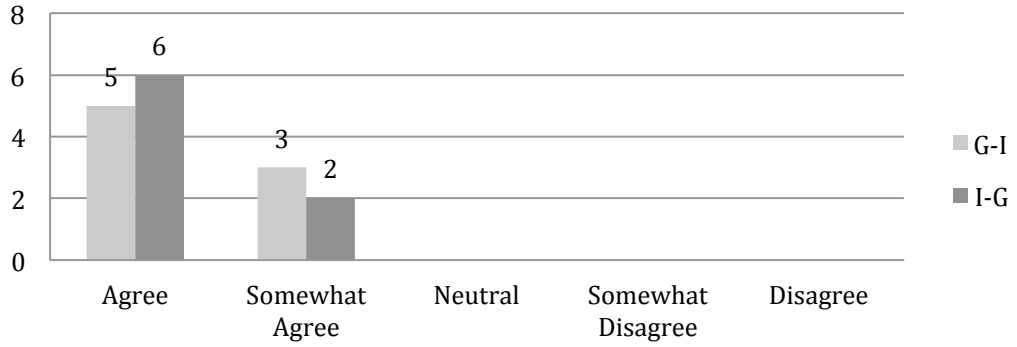

Figure 31. Response to Statement 8 (Sequence comparison)

Of the 16 participants, 11 (68.75%) Agreed, and 5 (31.25%) Somewhat Agreed with the statement "I am satisfied with the results of the brainstorming session."

Statement 9. I enjoyed actively participating on my own behalf during the brainstorming session.

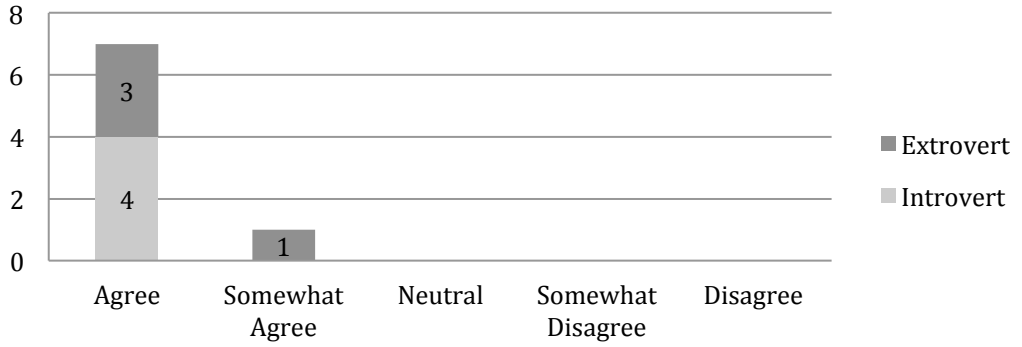

Figure 32. Response to Statement 9 (G-I Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) Somewhat Agreed with the statement ”I enjoyed actively participating on my own behalf during the brainstorming session.”

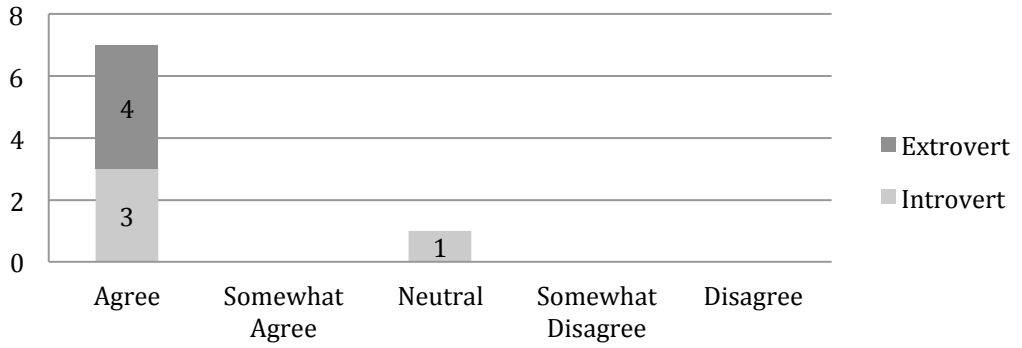

Figure 33. Response to Statement 9 (I-G Sequence)

Of the 8 participants, 7 (87.5%) Agreed, and 1 (12.5%) was Neutral with the statement ”I enjoyed actively participating on my own behalf during the brainstorming session.”

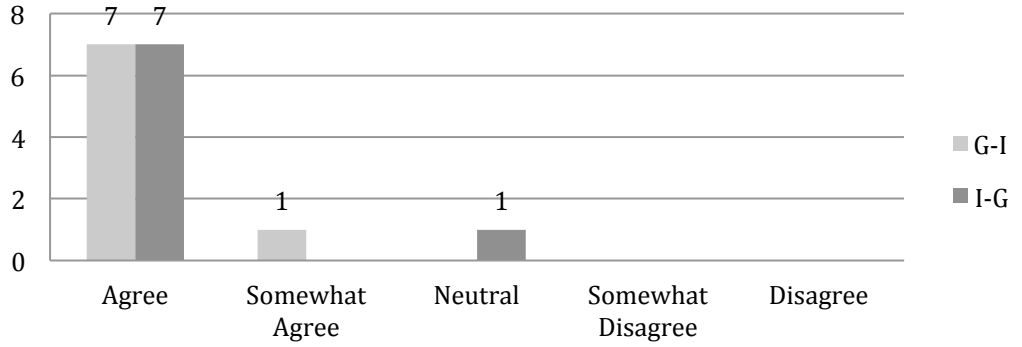

Figure 34. Response to Statement 9 (Sequence comparison)

Of the 16 participants, 14 (87.5%) Agreed, 1 (6.25%) was Neutral, and 1 (6.25%) Somewhat Agreed with the statement ”I enjoyed actively participating on my own behalf during the brainstorming session.”

Statement 10. I enjoyed working independently during the brainstorming session.

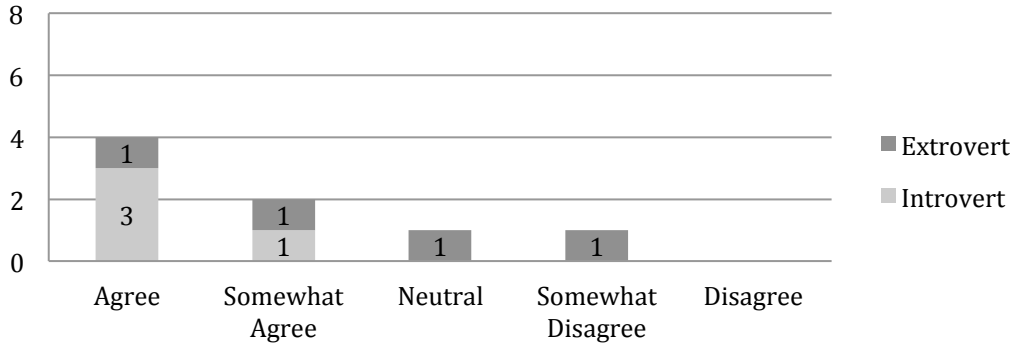

Figure 35. Response to Statement 10 (G-I Sequence)

Of the 8 participants, 4 (50%) Agreed, 2 (25%) Somewhat Agreed, 1 (12.5%) was Neutral, and 1 (12.5%) Somewhat Disagreed with the statement “I enjoyed working independently during the brainstorming session.”

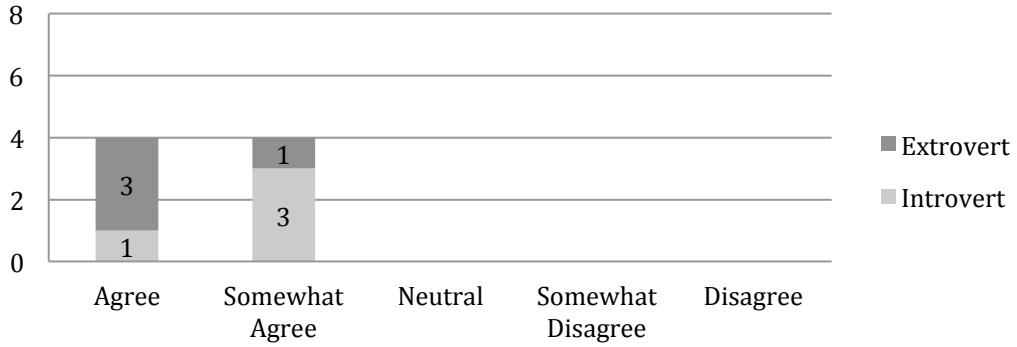

Figure 36. Response to Statement 10 (I-G Sequence)

Of the 8 participants, 4 (50%) Agreed, and 4 (50%) Somewhat Agreed with the statement "I enjoyed working independently during the brainstorming session."

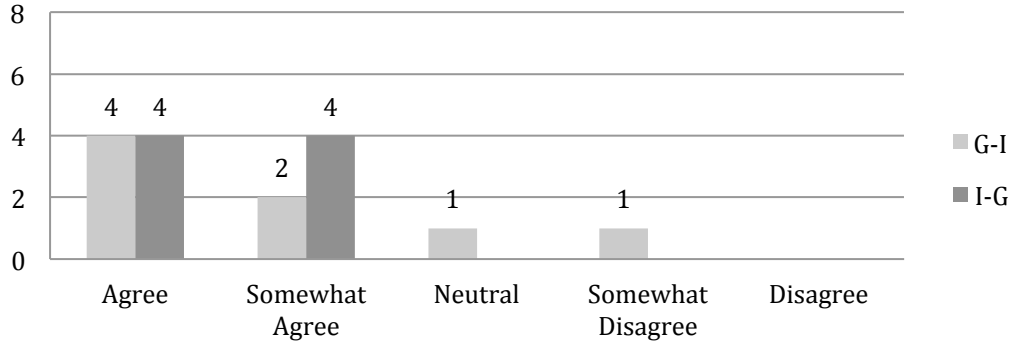

Figure 37. Response to Statement 10 (Sequence comparison)

Of the 16 participants, 8 (50%) Agreed, 6 (37.5%) Somewhat Agreed, 1 (6.25%) was Neutral, and 1 (6.25%) Somewhat Disagreed with the statement "I enjoyed working independently during the brainstorming session."

Statement 11. I enjoyed being a part of the group during the brainstorming session.

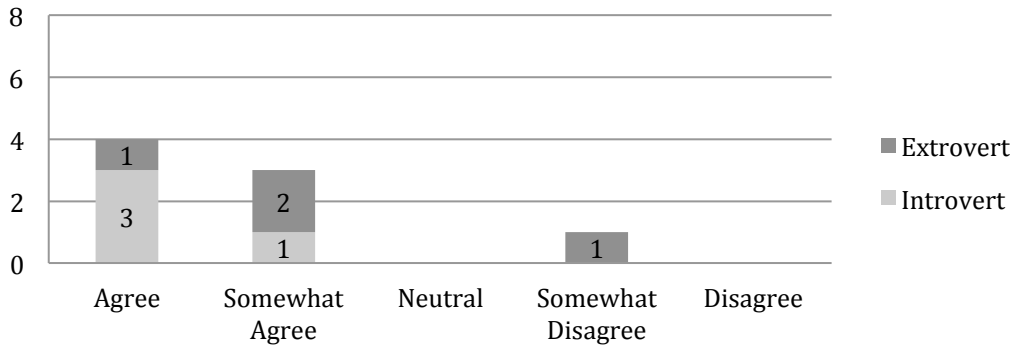

Figure 38. Response to Statement 11 (G-I Sequence)

Of the 8 participants, 4 (50%) Agreed, 3 (37.5%) Somewhat Agreed, and 1 (12.5%) Somewhat Disagreed with the statement "I enjoyed being a part of the group during the brainstorming session."

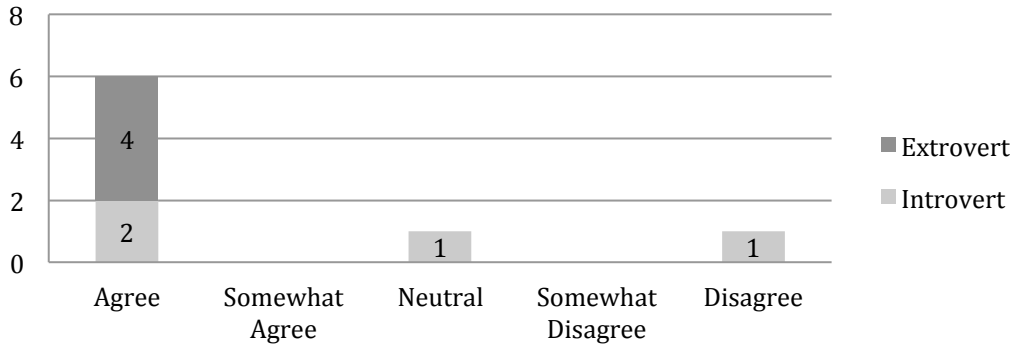

Figure 39. Response to Statement 11 (I-G Sequence)

Of the 8 participants, 6 (75%) Agreed, 1 (12.5%) was Neutral, and 1 (12.5%) Disagreed with the statement "I enjoyed being a part of the group during the brainstorming session."

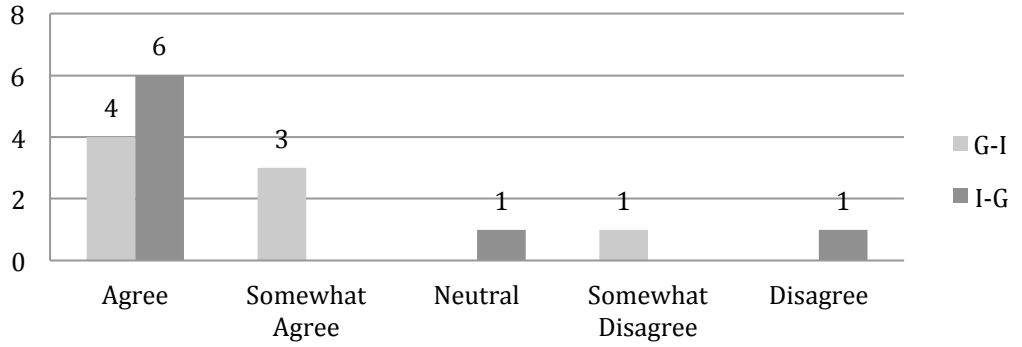

Figure 40. Response to Statement 11 (Sequence comparison)

Of the 16 participants, 10 (62.5%) Agreed, 3 (18.75%) Somewhat Agreed, 1 (6.25%) was Neutral, 1 (6.25%) Somewhat Disagreed, and 1 (6.25%) Disagreed with the statement "I enjoyed being a part of the group during the brainstorming session."

Statement 12. I am satisfied with the structure of the brainstorming session.

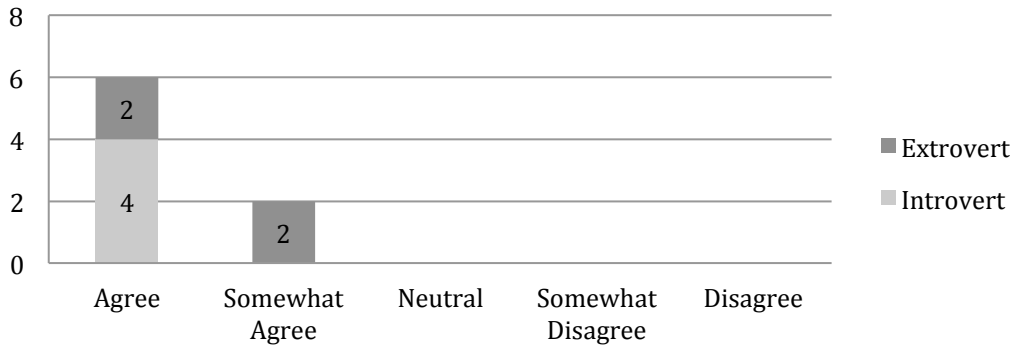

Figure 41. Response to Statement 12 (G-I Sequence)

Of the 8 participants, 6 (75%) Agreed, and 2 (25%) Somewhat Agreed with the statement "I am satisfied with the structure of the brainstorming session."

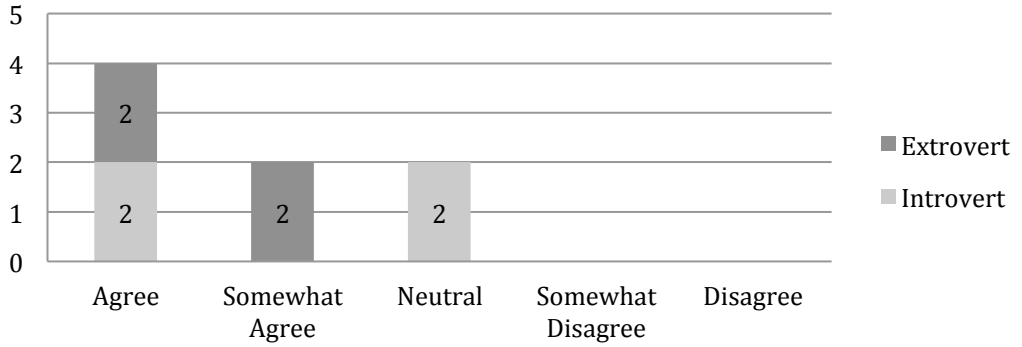

Figure 42. Response to Statement 12 (I-G Sequence)

Of the 8 participants, 4 (50%) Agreed, 2 (25%) Somewhat Agreed, and 2 (25%) were Neutral with the statement ”I am satisfied with the structure of the brainstorming session.

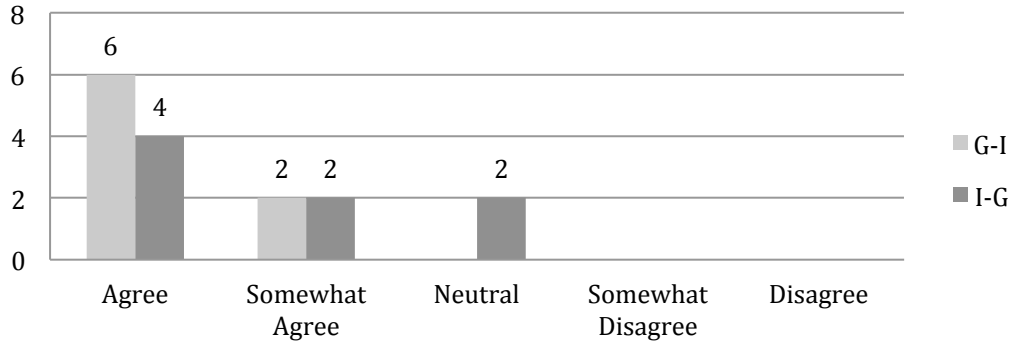

Figure 43. Response to Statement 12 (Sequence comparison)

Of the 16 participants, 10 (62.5%) Agreed, 4 (25%) Somewhat Agreed, and 2 (12.5%) were Neutral with the statement “I am satisfied with the structure of the brainstorming session.”

Average number of ideas generated per participant per session segment (a/b)

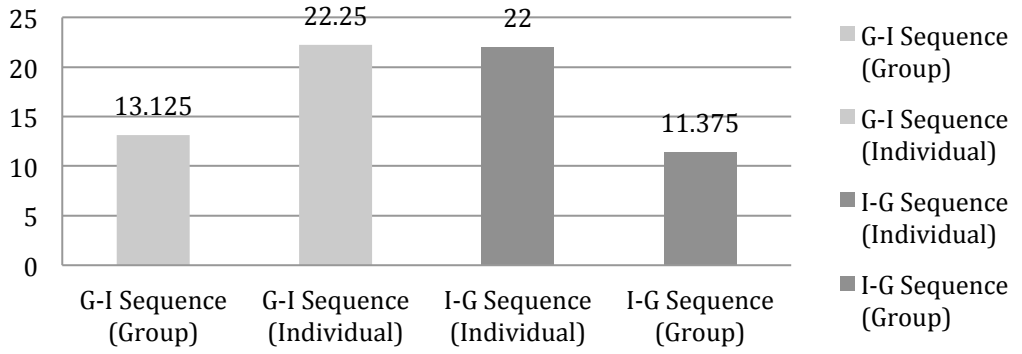

Figure 44. Average number of ideas generated per participant per session segment (a/b)

G-I Sequence (Group) produced an average of 13.125 ideas per participant, G-I Sequence (Individual) produced an average of 22.25 ideas per participant, I-G Sequence (Individual) produced an average of 22 ideas per participant, and I-G Sequence (Group) produced an average of 11.375 ideas per participant.

Average number of ideas generated per participant per Sequence

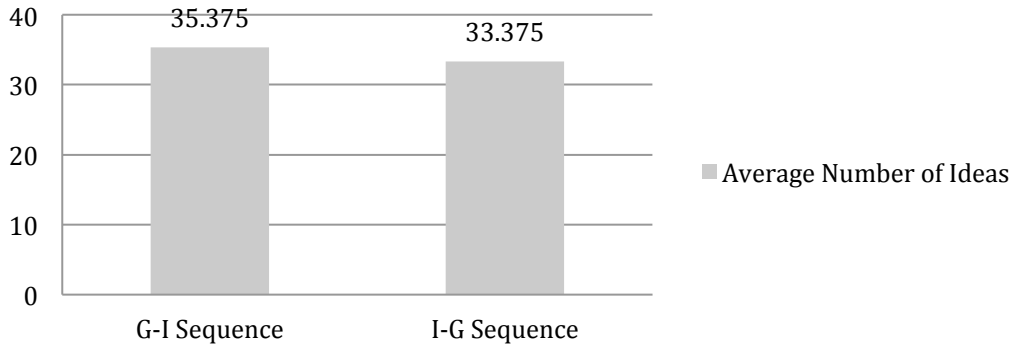

Figure 45. Average number of ideas generated per participant per Sequence

G-I Sequence generated an average of 35.375 ideas per participant, and I-G Sequence generated an average of 33.375 ideas per participant. The difference between the two sessions was 2 more ideas generated on average in favor of G-I Sequence (Group+Individual).

Average number of ideas generated per participant per session (Introvert/Extrovert comparison)

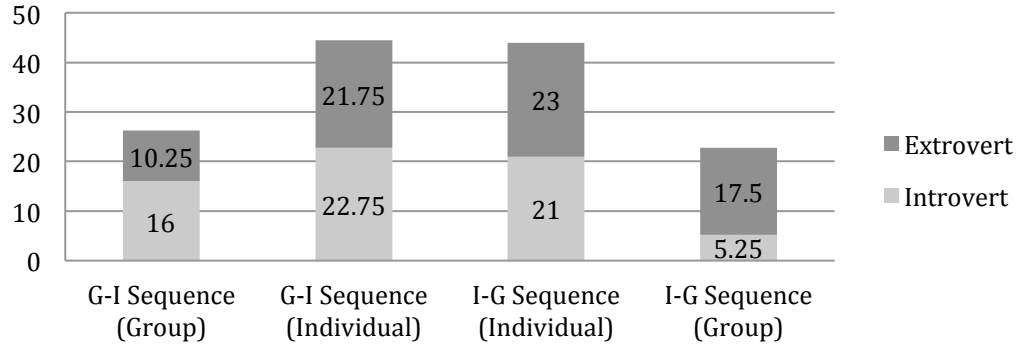

Figure 46. Average number of ideas generated per participant per session (Introvert/Extrovert comparison)

In G-I Sequence's group session, Extroverts generated an average of 10.25 ideas per participant, and Introverts generated an average of 16 ideas per participant for a difference of 5.75 more ideas generated on average in favor of the Introverted participants. In G-I Sequence's individual session, Extroverts generated an average of 21.75 ideas per participant, and Introverts generated an average of 22.75 ideas per participant for a difference of 1 more idea generated on average in favor of the Introverted participants. In I-G Sequence's individual session, Extroverts generated an average of 23 ideas per participant, and Introverts generated an average of 21 ideas per participant for a difference of 2 more ideas generated on average in favor of the Extroverted participants. In I-G Sequence's group session, Extroverts generated an average of 17.5 ideas per participant, and Introverts generated an average of 5.25 ideas per participant for a difference of 12.25 more ideas generated on average in favor of the Extroverted participants.

Chapter 5

CONCLUSIONS AND IMPLICATIONS

This study investigated three different aspects of brainstorming: those of real efficacy, perceived efficacy, and participant satisfaction with each process. Because only two sessions were compared against each other, statistical analysis was not feasible. However, there are certain insights that can be gained from the data that was gathered.

Real Efficacy

Question: Which is the most effective two-step alternating sequence of brainstorming sessions that produces the greater number of unique ideas?

Hypothesis 1, which suggested the sequence of real group then individual brainstorming would produce a greater number of ideas, was supported. The G-I Sequence produced a total of 283 ideas while the I-G Sequence produced 267, a total difference of 16 ideas. Alternatively, G-I Sequence participants generated an average of 35.375 ideas and I-G Sequence participants generated an average of 33.375 ideas for a difference on average of 2 ideas more (6%) per participant in the G-I Sequence. Personality type did not appear to contribute to number of ideas generated per brainstorming segment; Extroverts did not consistently do better in the group setting nor did Introverts produce more in the individual setting.

Number of ideas generated per session					
	Session 1a (G)	Session 1b (I)	Session 2a (I)	Session 2b (G)	Total
Extrovert	41	87	92	70	290
Introvert	64	91	84	21	260
Sub Total	105	178	176	91	550
Grand total	283		267		

Table 1. Number of ideas generated per session

Average number of ideas per participant per session					
	Session 1a (G)	Session 1b (I)	Session 2a (I)	Session 2b (G)	Total
Extrovert	10.25	21.75	23	17.5	18.125
Introvert	16	22.75	21	5.25	16.25
Sub Total	13.125	22.25	22	11.375	17.1875
Grand Total	35.375		33.375		

Table 2. Average number of ideas generated per participant per session

Perceived Efficacy

Question: Which session sequence will be perceived by the participants as being most effective?

Hypothesis 2, which stated "for the introverts, the brainstorming sequence of group session followed by individual session will be perceived as more effective than that of the individual then group session," was supported. The data collected suggests that introverts perceived the G-I Sequence as being more effective with a combined perceived efficacy score of 105, as opposed to that of the I-G Sequence that had a combined perceived efficacy score of 97 (out of a possible 120).

Hypothesis 3, which stated "for the extroverts, the brainstorming sequence of individual session followed by group session will be perceived as more effective than that of the group then individual session," was shown to be incorrect. The data collected suggests that extroverts perceived the G-I Sequence as being more effective with a combined perceived efficacy score of 112, as opposed to that of the I-G Sequence that had a combined perceived efficacy score of 82 (out of a possible 120).

In order to determine the perceived efficacy of the sessions, participants were asked to rate questionnaire statements on a five-point Likert-type scale of Agree / Somewhat Agree / Neutral / Somewhat Disagree / Disagree. These answers were assigned a point value between 1 and 5 and then added together to produce results (within a range of 6-120) that would be more easily visible in a radar-type graph. These statements were:

Statement 1. The brainstorming session was successful.

Statement 2. The brainstorming session generated a sufficient number of ideas.

Statement 3. The structure of the session allowed me to contribute all the ideas I wished to contribute.

Statement 4. The structure of the session facilitated the flow of ideas.

Statement 5. Each participant was provided enough opportunity to participate in the group brainstorm.

Statement 6. Some participants contributed more than others in the group.

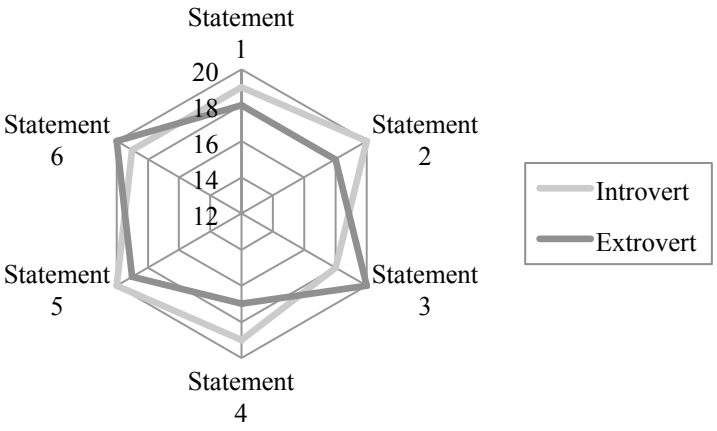

Figure 47. Radar Graph – G-I Sequence: Statements of Perceived Efficacy

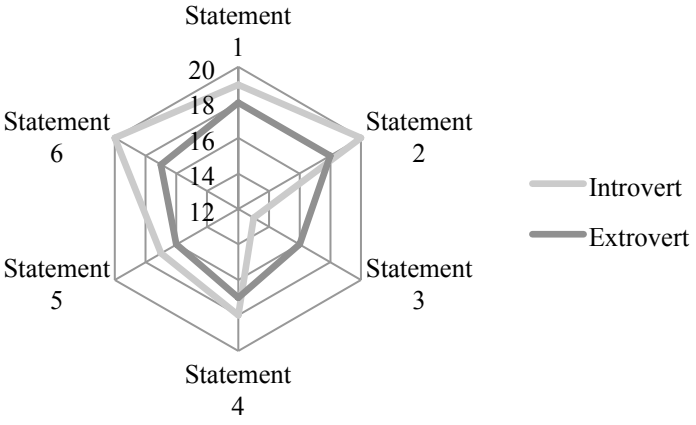

Figure 48. Radar Graph – I-G Sequence: Statements of Perceived Efficacy

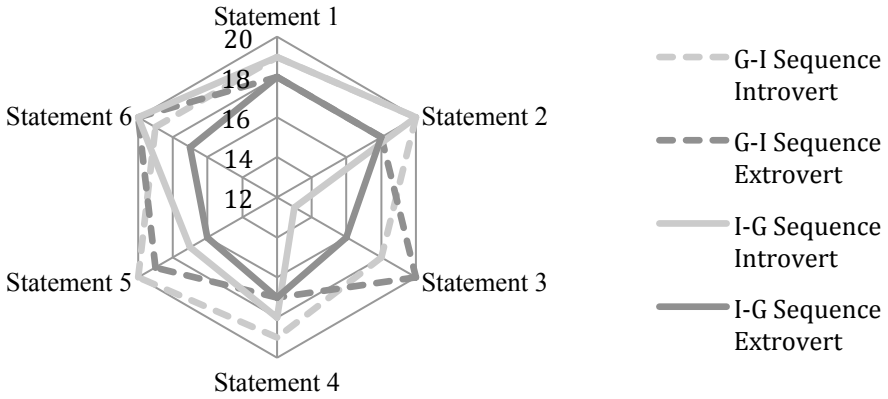

Figure 49. Radar Graph –G-I Sequence and I-G Sequence comparison: Statements of Perceived Efficacy

	Perceived Efficacy			
	G-I Sequence		I-G Sequence	
	Introvert	Extrovert	Introvert	Extrovert
Statement 1	19	18	19	18
Statement 2	20	18	20	18
Statement 3	18	20	13	16
Statement 4	19	17	18	17
Statement 5	20	19	17	16
Statement 6	19	20	20	17
Total	105	112	97	82

Table 3. G-I Sequence and I-G Sequence: Statements of Perceived Efficacy – Scoring

Satisfaction

Question: Which session sequence will produce a higher level of self-reported satisfaction with the results of the brainstorming session?

Hypothesis 4, which stated "for the introverts, the brainstorming sequence of group session followed by individual session will be self-reported as more satisfying than that of the individual then group session," was supported. The data collected suggests that introverts were more satisfied with the G-I Sequence with a combined satisfaction score of 116 as opposed to that of the I-G Sequence that had a combined satisfaction score of 102.

Hypothesis 5, which stated "for the extroverts, the brainstorming sequence of individual session followed by group session will be self-reported as more satisfying than that of the group then individual session," was supported. The data collected suggests that extroverts were more satisfied with the I-G Sequence with a combined satisfaction score of 116 as opposed to that of the G-I Sequence that had a combined satisfaction score of 102.

The statements used to determine the satisfaction of the sessions were:

Statement 7. I am satisfied with my role in the brainstorming session.

Statement 8. I am satisfied with the results of the brainstorming session.

Statement 9. I enjoyed actively participating on my own behalf during the brainstorming session.

Statement 10. I enjoyed working independently during the brainstorming session.

Statement 11. I enjoyed being a part of the group during the brainstorming session.

Statement 12. I am satisfied with the structure of the brainstorming session.

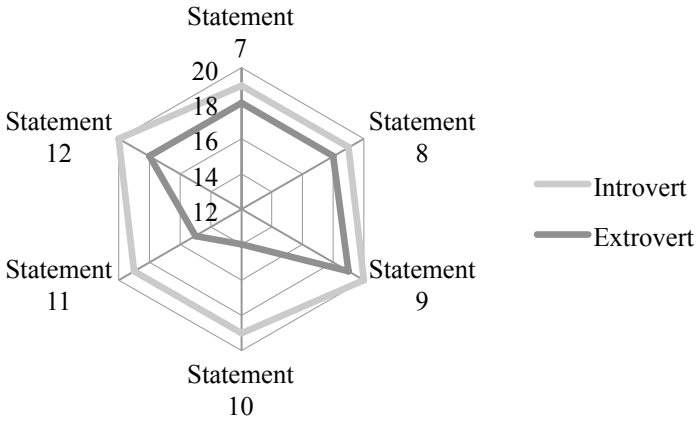

Figure 50. Radar Graph – G-I Sequence: Statements of Satisfaction

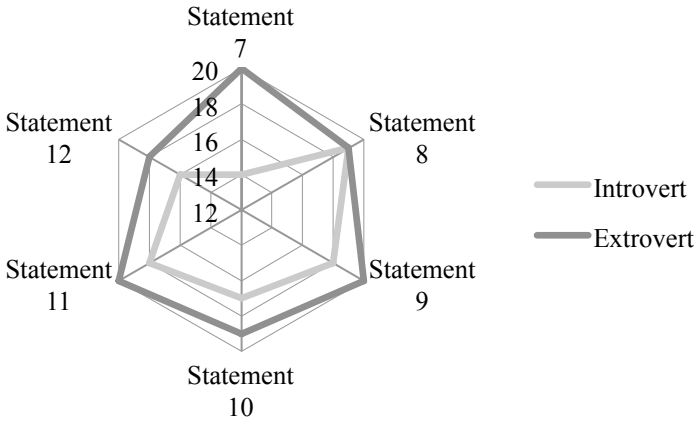

Figure 51. Radar Graph – I-G Sequence: Statements of Satisfaction

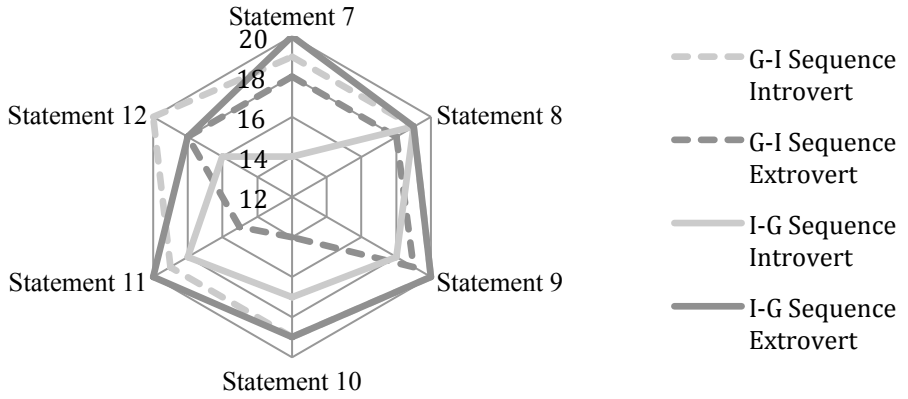

Figure 52. Radar Graph – G-I Sequence and I-G Sequence comparison: Statements of Satisfaction

	Satisfaction			
	G-I Sequence		I-G Sequence	
	Introvert	Extrovert	Introvert	Extrovert
Statement 7	19	18	14	20
Statement 8	19	18	19	19
Statement 9	20	19	18	20
Statement 10	19	14	17	19
Statement 11	19	15	18	20
Statement 12	20	18	16	18
Total	116	102	102	116

Table 4. G-I Sequence and I-G Sequence: Statements of Satisfaction – Scoring

Limitations Experienced

Broad range of experience levels among participants

As was determined by observation during the sessions and by self reported answers on the surveys completed after each session, there was a wide range of previous experience represented among the volunteers. Those with more experience and more confidence quickly jumped into the task and began producing ideas immediately. Those with less experience and confidence took longer to get started, appeared anxious about performance, and were less likely to fully engage the task at hand. It is possible that results of this study may have been different if all participants had similar experience with brainstorming and were more comfortable with the process right from the start without any sort of "warming-up" period.

A limited grasp of the English language

One of the student volunteers was not a native English speaker, and as such, was severely handicapped in her understanding and efficacy within the study. It was not fully discovered that this was a possible issue until the session had already begun, and in an effort to keep my interaction as a facilitator with all the participants at as similar a level as possible, I refrained from giving this specific individual any specialized coaching or any expanded explanation.

Limited availability of volunteers

The available pool of volunteers was limited to one semester of students attending the Finding Purpose class. After an invitation to participate was extended before class and

followed up by an email to the 240 students enrolled in the class, only 34 of those who responded were available within the time and date constraints set aside for the study. This allowed for one full group of each of the alternating sequences, but not enough to run a second study. Ideally, conducting additional rounds of each alternating sequence would have allowed for more concrete analysis with the additional data provided, but with only one of each sequence session to compare against each other, statistical analysis is not possible.

Range of commitment level to the study

While some of the participants were genuinely interested in the research study, the process, and the results, other participants appeared to be most interested in available food, drink, and the possibility of extra credit for their Finding Purpose class. Those with a higher level of commitment appeared to be more focused on the task and eager to produce as many solutions as possible, while others appeared to be more interested in socializing with and entertaining each other.

Production Blocking

Through the use of the Post-It Note method of group brainstorming it was observed that production blocking was still present in spite of efforts to eliminate it. Even though participants were instructed to write ideas and place them as quickly as possible and not worry about taking turns, there still became a noticeable flow of participants waiting for others to speak and place notes on the group wall. It should be noted that though production blocking was observed in both group brainstorming sessions, the

majority of participants in the session ending with individual brainstorming self-reported a much higher agreement with the statements “The structure of the session allowed me to contribute all the ideas I wished to contribute” and “Each participant was provided enough opportunity to participate in the group brainstorm” than those in the session ending with group brainstorming. It may be possible, that with the individual segment being most recent in their minds, that the participants did not necessarily recall being limited by others during the group portion of the sequence. Production blocking was not observed during the individual portion of the brainstorming session.

Evaluation Apprehension

Evaluation apprehension was observed during both the group and the individual portions of the brainstorming session. In the group session it was visible as some participants stood back away from the group, participating less than others and not engaging as often. In the individual session evaluation apprehension was not as obvious as the during the group session, but behaviors such as covering up notes with hands, stacking notes on top of each other, or hunched body posture could be indicative of a desire to limit the ability of other participants to observe the ideas written down or the quantity of ideas produced.

Questionnaire Limitations

The questions used on the questionnaire gave static answers but no insight as to why the participant felt the way they did. Including a “why?” or “please explain” to the form in addition to the Agree/Disagree scale could have provided additional useful

information and insight into how the participants perceived the exercise. It should be noted that all the questions were phrased with a positive connotation. Responses may have differed if participants were asked to Agree/Disagree with a negative statement such as "each participant was NOT provided enough opportunity to participate in the group brainstorm."

Implications for Policy and Practice

In his 2012 article, Bob Sutton states that "Most of this research is done with novices rather than skilled brainstormers, only looks at one measure (quantity), and ignores how brainstorming is done and the impact it has in real organizations." In contrast, Taylor, Berry & Block's 1958 study stated that "more training and experience in following the basic rules of brainstorming than that received by the present subjects might well be expected to facilitate in the productions of ideas." But at the same time "such training and experience would be expected to improve the performance of nominal as well as real groups." They state, "It appears probable that with more highly trained subjects essentially the same conclusion would be reached as in the present study" (Taylor, Berry & Block, 1958).

I believe that for a session to be most successful in terms of efficacy, perceived efficacy, and satisfaction there should be a confident figure leading and guiding the process, acting as a facilitator to be responsible for activities before, during, and after the brainstorming. It would be highly beneficial to have a leader who reinforces guidelines and encourages participation of all group members. In fact, studies have shown that groups with a facilitator do better than those without, and that having a trained facilitator

enhances productivity and manages or even eliminates many of the barriers to productive brainstorming (Bradley & Hebert, 1997; Isaksen & Gaulin, 2005).

All other things being equal, my feeling is that experience with brainstorming in general is going to be more important than experience with the specific task being addressed. Also, if the task is sufficiently explained and the desired result is clear, a team with broad life experience should be able to produce many plausible solutions.

Future Research

Video Recording

Utilizing video as a means to capture the session may provide additional qualitative insight into how the participants interact with each other and how their self-reported perception of the session could be compared to an outside observer's perception of the same session. While in the midst of a brainstorming session it may be hard for the researcher to observe all of the subtle group interactions, but with a visual recording of the event, it would be possible to go back and see when and where barriers to productive brainstorming occurred, when the session became more or less energized, and if there were certain specific triggers that could be actively used or avoided to maximize the overall productivity of the session.

Length of Brainstorming Session

It could be beneficial to see if there is an optimal time component to the brainstorming sessions. Is there a certain "sweet spot" time-wise in the process where participants are most active, engaged, and productive? Is there a quantifiable point when

effectiveness drops off and participants become fatigued with the process? Perhaps by utilizing a time stamped video one could better look at the ebb and flow of the brainstorming activity and determine when a good stopping point should be.

Other Personality Type and Temperament Considerations

What additional information and insight could be gained by looking the other MBTI components in conjunction with brainstorming results? Are certain psychological types more or less prone to the typical barriers in brainstorming? Are some more or less critical of the process and the results? How would homogeneous or heterogeneous group compositions compare? It would be interesting to look into whether or not it makes sense to have greater diversity of personality types involved or groups that are more aligned in preference.

Expert vs. Amateur

One could look at, and have an outside third party evaluate, the results of having knowledgeable "experts" brainstorm on a topic vs. those with only broad general experience with the topic. Do those with extensive prior knowledge also bring with them biases and blind spots, sticking to a relatively typical line of thought and scope of solutions? Would those without the specialized knowledge be able to find more novel approaches to solving the problem and come up with viable solutions that the others were unable to conceptualize?

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APPENDIX A

IRB APPROVAL FORM

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	William Heywood AED
From:	Mark Roosa, Chair Soc Beh IRB
Date:	04/21/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	04/21/2011
IRB Protocol #:	1104006341
Study Title:	In Search of Better Brainstorming Through a two Step Process

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(1) (2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

APPENDIX B

INFORMATION LETTER

INFORMATION LETTER
Group Interviews or Focus Groups

In Search of Better Brainstorming Through a Two-Step Process

Date

Dear _____:

I am a graduate student under the direction of Professor William Heywood in The Design School at Arizona State University. I am conducting a research study to assess and describe the benefits of using a two-step brainstorming process. This study will examine two different processes for brainstorming used in conjunction with each other in two separate sessions, albeit in different orders of operations for each session. Many studies have been done on a single aspect of brainstorming, but none have looked at the results of a two-step process such as this.

I am inviting your participation, which will involve your participation in two separate brainstorming sessions, one with a group and one as an individual. The brainstorming sessions will last 10 minutes, and there will be time after each for completion of a survey questionnaire. The total time commitment for this study will be approximately 30 minutes. You have the right not to answer any question, and to stop the interview at any time.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty, it will not affect your grade. You must be 18 or older to participate in the study.

(Although there is no direct benefit to you, the possible benefits of your participation in the research are the advancement of understanding of group and nominal brainstorming when used in conjunction with each other. There are no foreseeable risks or discomforts to your participation.

Your responses will be anonymous. The results of this study may be used in reports, presentations, or publications but your name will not be known.

If you have any questions concerning the research study, please contact the research team at: William Heywood, william.heywood@asu.edu 602.369.3261 or Michael Marinello, michael.marinello@asu.edu 480.275.9182. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

By signing below you are agreeing to participate to in the study.

_____ _____
Signature Date

APPENDIX C

CONSENT FORM

CONSENT FORM
INDIVIDUAL AND GROUP BRAINSTORMING

INTRODUCTION
The purposes of this form are to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research and to record consent of those who agree to be involved in the study.

RESEARCHERS
Clinical Assistant Professor William Heywood, of the School of Design Innovation and School of Design Innovation MSD Student Michael Marinello have invited your participation in a research study.

STUDY PURPOSE
The purpose of this research is to assess and describe the benefits of using a two-step brainstorming process. This study will examine two different processes for brainstorming used in conjunction with each other in two separate sessions, albeit in different orders of operations for each session. Many studies have been done on a single aspect of brainstorming, but none have looked at the results of a two-step process such as this.

DESCRIPTION OF RESEARCH STUDY
If you decide to participate, then you will join a study involving research of group and nominal brainstorming techniques. You will also be asked to complete a survey in response to your perception of the efficacy of the process. If you say YES, then your participation will be approximately 30-45 minutes.

RISKS
There are no know risks from taking part in this study, but in any research, there is some possibility that you may be subject to risks that have not yet been identified.

BENEFITS
Although there may be few direct benefits to you, the possible benefits of your participation in the research are the advancement of understanding of group and Individual brainstorming when used in conjunction with each other.

CONFIDENTIALITY
All information obtained in this study is strictly anonymous. The results of this research study may be used in reports, presentations, and publications, but your name will not be known.

WITHDRAWAL PRIVILEGE
Participation in this study is completely voluntary. It is ok for you to say no. Even if you say yes now, you are free to say no later, and withdraw from the study at any time. Your decision will not affect your relationship with Arizona State University or otherwise cause a loss of benefits to which you might otherwise be entitled.

COSTS AND PAYMENT
The researchers want your decision about participating in the study to be absolutely voluntary. There is no payment for your participation in the study.

Voluntary Consent
Any questions you have concerning the research study or your participation in the study, before or after your consent, will be answered by William Heywood, william.heywood@asu.edu 602.369.3261 or Michael Marinello, michael.marinello@asu.edu 480.275.9182.
If you have questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk; you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at 480-965 6788.

This form explains the nature, demands, benefits and any risk of the project. By signing this form you agree knowingly to assume any risks involved. Remember, your participation is voluntary. You may choose not to participate or to withdraw your consent and discontinue participation at any time without penalty or loss of benefit. In signing this consent form, you are not waiving any legal claims, rights, or remedies. A copy of this consent form will be given (offered) to you.

Your signature below indicates that you consent to participate in the above study.

_____	_____	_____
Subject's Signature	Printed Name	Date
_____	_____	_____
Legal Authorized Representative (if applicable)	Printed Name	Date

INVESTIGATOR'S STATEMENT
"I certify that I have explained to the above individual the nature and purpose, the potential benefits and possible risks associated with participation in this research study, have answered any questions that have been raised, and have witnessed the above signature. These elements of Informed Consent conform to the Assurance give by Arizona State University to the Office for Human Research Protections to protect the rights of human subjects. I have offered the subject/participant a copy of this signed consent document."

Signature of Investigator _____ Date_____

APPENDIX D

SEQUENCE G-I PARTICIPANT DATA

Session 1 (G-I)									
	Participant	1	2	3	4	5	6	7	8
	MBTI	INFP	INFP	ENFP	INTP	ENTP	INTP	ESTP	E
	Number of Ideas (1a-G)	20	11	17	14	6	9	15	13
	Number of Ideas (1b-I)	20	28	17	25	18	18	30	22
	Grand Total	40	39	34	39	24	27	45	35

General Questions									
Q1	Prior to this study, have you participated in a group brainstorming session?	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Q2	How much time, before this study, have you spent in brainstorming sessions?	6-8 Hours	6-8 Hours	0-2 Hours	0-2 Hours	10+ Hours	0-2 Hours	10+ Hours	6-8 Hours
Q3	In what environments have you used brainstorming? (circle all that apply)	P/E	P/E	E	P	B/P/E	B/P/E	B/P/E	B/E

Perceived Efficacy									
S1	The brainstorming session was successful	A	A	A	SA	A	A	N	A
S2	The brainstorming session generated a sufficient number of ideas	A	A	A	A	A	A	N	A
S3	The structure of the session allowed me to contribute all the ideas I wished to contribute	A	A	A	A	A	N	A	A
S4	The structure of the session facilitated the flow of ideas	A	A	A	A	A	SA	N	SA
S5	Each participant was provided enough opportunity to participate in the group brainstorm	A	A	SA	A	A	A	A	A
S6	Some participants contributed more than others in the group	SA	A	A	A	A	A	A	A

Satifaction									
S7	I am satisfied with my role in the brainstorming session	A	A	SA	SA	A	A	A	SA
S8	I am satisfied with the results of the brainstorming session	A	A	SA	SA	A	A	A	SA
S9	I enjoyed actively participating on my own behalf during the brainstorming session	A	A	SA	A	A	A	A	A
S10	I enjoyed working independently during the brainstorming session	SA	A	N	A	A	A	SA	SD
S11	I enjoyed being a part of the group during the brainstorming session	A	A	SA	SA	SD	A	SA	A
S12	I am satisfied with the structure of the brainstorming session	A	A	A	A	A	A	SA	SA

Session 1 (G-I)								
Participant	1	2	3	4	5	6	7	8
MBTI	INFP	INFP	ENFP	INTP	ENTP	INTP	ESTP	E
Number of Ideas (1a-G)	20	11	7	24	6	9	15	13
Number of Ideas (1b-I)	20	28	17	25	18	18	30	22
Grand Total	40	39	24	49	24	27	45	35

Group Ideas (1a-G)								
Participant	1	2	3	4	5	6	7	8
1	American Idol	A card that is a permanent ticket	Bed seats	25 year Macallen	Entertainment for kids on waiting area	Cheaper food @ airport	assign seats at all times	All 1st class
2	Better Food	Babies in front or back	Flight concert	Airline "ID" card	Jazz & other music choices on planes	Different swell in plane	Bag crew held accountable	Bigger bathroom
3	Cell Phone Use	Exit on the sides	Huge dog beside me	Ambient music	More outlets & work stations on waiting area	Free wi-fi	Better parking on transit	Bigger overhead
4	Child Play Area	Fewer automated announcements - more real people	Only me	Annie's pretzels gourmet	More plane drinks 4 free	More seating room	Get rid of TSA, customs do it all	Bigger seats
5	Every Ticket Counter Open	Interesting signs (directions)	problem again and again	Baby noise canceling devices	Revolving plane chairs w/ tables	No close talkers	More direct flights	Blankets
6	Fitness Room	Kinder Employees	Run out of electricity	Better looking flight attendents	Shading on the windows waiting area	No crying babies	More flight attendants	Cheaper
7	Flying Pods	Knowledge on why electronics must be turned off	Wrong destination	Collapsable Luggage		No dilly dallying @ landing	More restrooms	Different cabins like a train
8	Free Bose Head Phones	Less AC		Faster planes		No lost luggage	Must mail luggage	Different TSA, Drinks allowed through
9	Heated Or Cooled Seats	More Patience		Fly yourself		Peanuts/pretzels	No 1st class	Keep electronics on always
10	Individual Seating Booth	No bag fee		Free puppies/kittens			No greeting by pilot, just take off	Less time
11	Insta Doze	Recycling on a plane		Horror plane for Halloween			No pets, not even in cargo	Real food
12	Insta Scan Security			Jetpacks			On board jails	TV, movies playing free
13	Massaging Chairs			Less seats			Parachutes	Unlimited bags
14	More Board Lanes			Limo partitions			Stretch area	
15	No More Breaking			More money			Wider selection of alcoholic beverages	
16	No More How To Buckle			More space				
17	No Odor Bath Room			More than one McDonalds				
18	Party Floor			Mute remote for friendlier neighbor				

Group Ideas (1a-G)								
Participant	1	2	3	4	5	6	7	8
19	Sound Proof Booth			P air supply				
20	Tracking Device			Pilot dance off				
21				Private security contractors				
22				Raffle for air marshall				
23				Tube travel				
24				Win a free flight				
Number of ideas generated	20	11	7	24	7	10	16	14

Individual Ideas (1b-l)								
Participant	1	2	3	4	5	6	7	8
1	Any food you want	Vegan/veggie restaurants	A car on the flight	"caldesac" seating hippie jam circle style	Aware of sleepers & talkers	1 price for unlimited alcoholic drinks	Assigned seats	More check in centers
2	Buy 1 get 1 free	text messages	bath tub	"pick-up" service plane - house	Bags under seat make for easy reach	3 carry-on max	Attitude check terminal/ "you're not the only one flying"	Walking sidewalk in every airport
3	Cameras outside of plane with video monitors	Self check-in weighs bags too	Donation	Amsterdam orgy flights	Comfortable for customers	B plane	Better parking/transit	Free flights foster
4	Child play room with padded & jumping walls	Security place for carry-on luggage while waiting	Drunk	Completely transparent fuselage	Easiness to get lost and have "space"	Carry-on only	Big restroom	Like a 5 star hotel
5	Faster plane	Reclaimed water features (fountains)	Freash green	Fusalage surfing	entertainment for children	Commision artists to paint planes	Bigger seats/leg space	No taxiing for 20 minutes
6	iPod hookup & charger	Movie screenings while waiting	Free travel around the world	Get to grope TSA	Group thinking & seating towards middle (think circles)	Cover charge gets you more	B folk designated Blackberry/if have use area	Nicer employees
7	Jetsons boarding sit in seat and sucked up	More UV lighting	Gif for everybody	Giant diamond hidden somewhere	Happy people waving good-bye	Fresh food	Clean restroom	All airports designed the same 0 confusion
8	Luggage shrinker	More plants	It's a party	Giraffes on leashes	keep groups together as possible	Fully reclining seats	Customs only/no TSA	No fees for anything
9	memory foam seats	More hand sanitiser	It's open to outside	Hammock seats on wings	Make system to separate them & keep groups together (revolving chairs	Healthy food	Direct flights more	Able to walk around
10	No craching planes	More color	Lost	Han Solo and Chewbacca pilots	Not animals - people sense	More efficient planes	Electronic use all times	TSA responsible for anything they break

Individual Ideas (1b-l)								
Participant	1	2	3	4	5	6	7	8
11	No fail security system	More chairs in waiting area	Love story	Joke telling veloci-raptor	Opportunity to be productive while traveling	No "terrorism" worries	Faster planes	No carry-on limit
12	On board spa	Lanes for walking	No food water	Levitation	Plenty of seating	Party plane	Free candy	Tons of security lines
13	pets allowed for free	GPS map app that records where you have flow	Noisy people	No escalators - tubes	Ready to fly at anytime	Power outlets in plane	Free hotel stay if flight is grounded	Same cost day before or 3 months in advance
14	Safer plane	Flight cancelation text	Pilot got a heart attack	No memory	Think groups - Families	Short flights like roller-coaster ride	Hotels at airport	Can bring liquids through
15	Showers	Fewer scare tactics	Sick people	No security	Think groups - individuals	Sleeping plane	I'm late 2 so shut up signs	Big comfy seats with pillow & blankets
16	Sky deck club	E displays	Speak man on the flight	Passenger militia	Time efficiency	Solar planes	Individual tv/headphones	If you have to wait an hour+ you get a free flight
17	Star trek beam	Biotic rooms	Sports field	Pick your own seat	Work stations with many outlets	Theme-park rides incorporated	Jail/holding cells	No weight limit for bags
18	Star trek beam up	Better places to rest		Pillows everywhere	Working headphones/channels/music	Themed planes	Kids area	Instruments NEVER get checked in TSA
19	Swimming pool	Better ladscape design of runways		Reenactments of plane movies			Luggage trackers free	All flights $50 each way in US
20	Video game room	better carpet designs		Seating by age group			More alcohol/free	Someone to carry all my stuff
21		Better car pick-up/drop off		Triplet flight attendents			More attendants	Free meal no matter how long the flight
22		Beeper for when boarding time comes		Virtual reality glasses			More booths	Free drinks
23		Aquariums		Voluntary anesthesia before flight			More service crew	
24		App that records options for more efficient flying		Warp speed			No "class" seating	
25		App that records money spent		Zepplin cruises			No announcements / just take off and land	
26		App that records fuel consumed					No restaurants, no nothing, it's a freaky airport get in-an-out	
27		Airline ticket/ID card universal					On-board nurse	
28		App that records miles traveles					Orderly boarding system	

Individual Ideas (1b-l)								
Participant	1	2	3	4	5	6	7	8
29							Require facemasks for germs	
30							Stretch play exercise "free room areas"	
Number of ideas generated	22	30	19	27	20	20	32	24

APPENDIX E

SEQUENCE I-G PARTICIPANT DATA

Session 2 (I-G)									
	Participant	1	2	3	4	5	6	7	8
	MBTI	ENTJ	ISTP	ENFP	ENFP	ISFJ	INTJ	ENFP	INTP
	Number of Ideas (1a-G)	26	19	23	17	15	35	26	15
	Number of Ideas (1b-I)	24	3	14	12	10	3	20	5
	Grand Total	50	22	37	29	25	38	46	20
General Questions									
Q1	Prior to this study, have you participated in a group brainstorming session?	Yes	yes	Yes	No	No	No	Yes	Yes
Q2	How much time, before this study, have you spent in brainstorming sessions?	0-2 Hours	0-2 Hours	0-2 Hours	0-2 Hours	0-2 Hours	0-2 Hours	6-8 Hours	10+ Hours
Q3	In what environments have you used brainstorming? (circle all that apply)	P / E	B / E	E	B / P/ E	P / E		B / P / E	B / P / E
Perceived Efficacy									
S1	The brainstorming session was successful	A	A	A	N	A	A	A	SA
S2	The brainstorming session generated a sufficient number of ideas	A	A	A	N	A	A	A	A
S3	The structure of the session allowed me to contribute all the ideas I wished to contribute	SA	A	A	SD	N	D	A	SA
S4	The structure of the session facilitated the flow of ideas	A	A	A	SD	A	N	A	A
S5	Each participant was provided enough opportunity to participate in the group brainstorm	A	A	SA	SD	A	N	A	SA
S6	Some participants contributed more than others in the group	SA	A	A	A	A	A	N	A
Satifaction									
S7	I am satisfied with my role in the brainstorming session	A	A	A	A	A	D	A	N
S8	I am satisfied with the results of the brainstorming session	A	A	A	SA	A	A	A	SA
S9	I enjoyed actively participating on my own behalf during the brainstorming session	A	A	A	A	A	A	A	N
S10	I enjoyed working independently during the brainstorming session	A	SA	SA	A	SA	A	A	SA
S11	I enjoyed being a part of the group during the brainstorming session	A	A	A	A	A	D	A	N
S12	I am satisfied with the structure of the brainstorming session	A	A	A	SA	A	N	SA	N

Session 2 (I-G)								
Participant	1	2	3	4	5	6	7	8
MBTI	ENTJ	ISTP	ENFP	ENFP	ISFJ	INTJ	ENFP	INTP
Number of Ideas (1a-G)	26	19	23	17	15	35	26	15
Number of Ideas (1b-I)	24	3	14	12	10	3	20	5
Grand Total	50	22	37	29	25	38	46	20

Individual Ideas (2a-I)								
	1	2	3	4	5	6	7	8
1	Cute security people	More security check lines	Personal TVs	Better texture on seats (they are itchy)	Wider seats	Seats	Baggage check in done with ID tags	Sleeping pills (wake up on arrival)
2	More airplanes	more comfortable seats	Make every class first class	Personal temp control	Leather seats	Comfort	Faster security check in	Do not remove shoes
3	Seats facing each other	bigger carry-on storage	Personal music players	See through security thing on people is not cool	More space on the plane	Attitude	Stop random testing	Pet "park"
4	Bed seats	wider seats	Change seat layouts - more communal, more space	Personal pods	Better airline meals (more options)	Service	Age appropriate check-in lines	Free parking
5	Talking on phones allowed	Better pillows	Get rid of fees fo bags	Change ugly blue color of seats (maybe grey or black)	More weight limit w/ luggage	Speed	Greater movie selection	Shuttle service from home
6	Personal TVs	Seat warmers	Personal cabin spaces	Option to watch movies on all flights Plug in iPods/iPhones to docking station	More employees, less operating machines	Better tech	Noise deafening seats	Free wi-fi
7	Better food	Food	Buffets on plane	Better ergonomic seating	Shortcuts to opposite sides of airport terminal	# of lines	Massage chairs	Electronic chargers
8	Separate bar	Better food	More alcohol	Chair backs need lumbar back adjust	Get private plane	Stream lined	Faster kiosk delivery	In flight video games
9	Free alcohol	Individual TVs	Bring back the pretty stewardesses	Stop charging for checked bags	Back check in not as expensive	Bag tagging	More competitive pricing	Library
10	Vibrating seats	Bigger show/movie selection	Games to play	Planes need better air freshener	Raise ammount of liquid allowed on a plane	Music to improve sleep & happiness	Have universal ID tags	Fold out beds
11	Heated/cooling seats	Wi-fi on planes	Curbside check in	More interactiveness - Temp control on docking station	More security checkpoints to same location	Less judgement	Crying baby/old people line	Inflatable pillows in seat
12	Wider planes	Friendly staff	Larger chairs	More interactiveness - Your own personal music	More outlets in airports	Better food	Smarter TSA agents	Massaging chairs
13	More bathrooms	live TV	Ergonomic chairs	More interactiveness - seat adjustments	More seats in terminals	Security	get rid of flight attendants - everything emchanized	Expand leg room

Individual Ideas (2a-l)								
	1	2	3	4	5	6	7	8
14	His/her bathroom	US news	More entertainment, more choices, not just the movie playing	Dinner should be served on all evening flights	Better planes that don't have weather delays	Less expensive	Healthier snack options	In-flight lounge (to get up and walk/relax)
15	Better feeling pillows & blankets	Cheaper tickets	A live map and display of where the plane currently is	Stop throwing away people's stuff that is over 3oz	More personal flight attendants	Maps	day-care for children	Greater menu variety
16	Nicer shuttles	Brighter colors on the plane	faster loading system	Plane background should be all white (bright is better)		Guides	Efficient security check in	
17	Shuttle limos	Open Bar	Improve security speeds	Have a system where you can pick it up after the flight with checked bags		Wider seats	Travel appropriate clothes	
18	Massages	Personal Chef	Live camera feeds of scenery below			Communicatio n	Smaller terminals for area of travel	
19	Spa on planes	Bring pets on board with you	Check in bag at gate, see bag go on plane			Movement	Food quality	
20	Performers on planes		Sleeping quarters for long flights			Offer free items - advil, water, earphones	Areas to rest or lie down	
21	People to carry bags		Broadband on all flights			Free sanoles(?)	Video of pre-flight instructions	
22	Wii available to play on plane		Sleeping rooms t airport for layovers			Bigger pillows	Limit bag sizes for women	
23	Gym on plane		Airport game rooms and kid play rooms for layovers			No babies are allowed	Digital updates to phone apps	
24	Weight of bags					Hop scotch during body checks	Drink fountains	
25	More carry-on space					Spot that cloud	More outlets / access to powerand the news	
26	Bookstore on plane					Captains riddle	Phone use on planes	
27						A game room on board		
28						Online chat rooms for the plane		
29						All babies get fed nyquil		
30						Hi-fives are mandatory		
31						If you beep at scanner you have to do a silly dance		

Individual Ideas (2a-l)								
	1	2	3	4	5	6	7	8
32						What's the point of a seat belt? Really?		
33						Bigger aisles on board		
34						More room		
35						Beds!!!		
Number of ideas generated	26	19	23	17	15	35	26	15

Group Ideas (2b-G)								
Participant	1	2	3	4	5	6	7	8
1	Allowed to walk on plane	Eject seats	Bigger windows	Better air fresheners	Boitiques on plane	Bigger pillows	Better movie options	Different size seats
2	Bar	no seats near bathroom	Faster security	Bigger plane	Cable on plane	Outlets	Child & old people section	Keep shoes on
3	Beds	No sick people	flinstone style	Bigger windows	Electric planes	Wider aisles	Comfier seat belts	Personal drop-off
4	Better feeling pillow & blankets		Fountain drinks	Cell phone use	Individual iPods		Directional viewing TVs	Pool on plane
5	Better Food		Free wi-fi	Cheaper tickets	More carry-on allowed		Early bird specials	Temp control
6	Cute security only		Glass floors	Interactive TVs (connect temp, seat control, movies)	More windows		Glass floor	
7	Facing seats		Hot tubs	Leather chairs	New blankets		Healthier food options	
8	Gym		Line map of where you are	Massage chairs	Pillows for everyone		Interactive flight system	
9	Heat / cooling chairs		More space for carry-ons	More drink choices	Private plane		Live music on planes	
10	His/Her bathrooms		No baggage fees	No bag fees	Wi-fi		Massage chairs	
11	Limo shuttles only		Noise cancelling headphones provided	Personal pods			More colorful planes	
12	Make space for carry-on		Phone chargers	Showers on overnight flights			Noise deafaning seats	
13	More bathrooms		Sleep quarters for layovers				On-plane day care	
14	Performers on plane		Sleeping pods				Phone use on planes	
15	Personal TV						Sauna	
16	Showers						Seat change options	
17	Solar pannels						Smarter TSA agents	
18	Spa						Smoking section	
19	Tables						Solar panel planes	
20	Tinting						Universal bag tags to drop off	
21	Vibrate seats							

Group Ideas (2b-G)								
Participant	1	2	3	4	5	6	7	8
22	Weed							
23	Weight limit							
24	Wider plane							
Number of ideas generated	24	3	14	12	10	3	20	5