Biases in Idea Screening: Exploring Gender Bias and First-Cast Vote Bias in the Process of Multivoting

A THESIS SUBMITTED TO THE FACULTY OF UNIVERSITY OF MINNESOTA

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

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May 2018

Table of Contents

Abstract

Idea generation and selecting ideas are two integral components in the design process. Before products or innovations can come to life, they must first be designed through the process of idea generation and selection. This investigation includes two studies that aim to determine if there is bias in the process of idea screening using multivoting. Both studies examine the process called multivoting which is used in team idea generation for selecting ideas. In these studies, the goal is to first determine if males are more likely than females to vote on their own ideas, and second to determine if the first ideas to receive any votes has an impact on the amount of total votes it receives from others on the team. In the first study, students brainstormed as many ideas as possible in ten minutes during class and then participated in multivoting. Results show that there is not enough of a difference between males and females to call it a bias, however there is an indication that there might be a bias toward ideas that receive votes first. In the second study, students came to class with ten ideas prepared. This process of multivoting was examined to see if there was a clear bias toward the ideas that first receive votes, as well as if a gender bias existed. Results from this study were similar to the first. There is not enough of a difference between males and females to call it a bias, however ideas that were the first to receive a vote got almost twice as many votes as ideas that were not first to receive a vote. Knowing when biases are likely to occur can help better the accuracy of idea screening, which can lead to more successful idea selections.

List of Figures

1.0 Introduction

Idea generation is the stage in the design process in which the idea is born. One type of idea generation process in which multiple ideas are created is called brainstorming (Osborn 1963). Characteristics of brainstorming include developing as many ideas as possible in one session, holding back from offering any judgements on ideas, and encouraging all ideas, no matter how “crazy.” Since brainstorming can be both an individual or team process, the characteristics for brainstorming are put into place in order to prevent people from holding back on their own creativity (Wilson 2013). This inevitably leads to having multiple ideas that make it difficult to narrow down which ones move forward in the process of development. This is where the concept of idea screening becomes important.

Idea screening is described as the initial selection of which new ideas should be selected for further development or rejected (Netz 2017). It is the stage in idea development after a set of ideas have been generated, and must be reduced to a manageable quantity of ideas for further development. Since not all ideas will continue in a design process it is important to select the strongest, most promising ideas. Sometimes, idea selection takes place when a board of executives makes the decisions based on their own rigid criteria (Onarheim & Christensen 2012), but sometimes teams also select ideas. According to Netz, literature suggests that there are two primary methods for selecting ideas: a rational approach and an intuitive approach (Magnusson et al., 2014, Akinci and

Sadler-Smith, 2012). The rational approach is described as being assessed with predefined criteria, whereas the intuitive approach is more of a hunch, a feeling, about the idea (Netz 2017).

One process that is used as a form of idea screening is the multivote. Multivoting is “a process in which each attendee is given two or more votes to be distributed among several alternatives” (Riel 2011). This can help immediately narrow down a large list of choices while being inclusive of all members of the team. Multivoting shares qualities of both rational and intuitive approaches of idea selection. Each person that is choosing which idea to vote on is assessing the idea using their own individual intuition or criteria. Traditionally, in host firms, multivoting occurs without any intervention from management, but recent literature suggests that the final stages of idea screening require firm intervention to be successful (Pradeep Kumar Ponnamma Divakaran 2017). Pradeep explains that the reasoning behind this is that “not all of the community’s popular ideas are implemented” due to the fact that new ideas are not always understood by every user, so firm intervention is important in selecting the best ideas.

For the scope of this research, there are two separate biases that are of particular interest when looking at multivoting: one involves gender and the other involves the first-cast votes. Research suggests that females tend to have lower self-esteem and a less positive perception of their own abilities in comparison to males (Toh, Strohmetz, & Miller 2016). There is also a known bias which is referred to as “ownership bias”, which occurs when the owner of an idea experiences an increased attachment to their ideas and artifacts (Nikander, Liikkanen, & Laakso 2014). Based on previous articles regarding confidence and decision making, we believe that males are more likely to vote on their own ideas than females due to a possible gender bias in how males perceive their own ideas. The other bias that this study aims to examine is a potential for more votes to be allocated to the first ideas that receive votes. As previously mentioned, one of the pitfalls of multivoting is that good ideas do not always receive the most votes because of factors such as not understanding the idea (Pradeep Kumar Ponnamma Divakaran 2017). When tested, people in general tend to have poor judgement of creative ideas, as they mostly selected feasible and desirable ideas over original ones (Rietzschel, Nijstad, & Stroebe 2010). Also, people are generally risk averse (Kahneman & Tversky 1979), so they might be more likely to vote on a popular idea as it is “less risky.” This study aims to determine if there is a gender bias and a first-cast-vote bias in the process of idea screening using multivoting with the goal of improving the accuracy of idea screening and idea development.

2.0 Background

Idea generation is a critical stage in the design process. The Geneplore model of creative thinking was created in 1992 to show that creative thinking is composed of phases of generation and exploration (Finke, Ward, & Smith, 1992). The generation stage involves the formation of associations between items by recalling them from memory, and the creation of new mental representations called structures. Exploration involves using those structures as building blocks to form new ideas. One type of organizational process that facilitates idea generation is brainstorming. This is either an individual or a team based idea generation process that increases creative efficacy while also solving problems (Wilson 2013). Often the goal of team based idea generation such as brainstorming is to develop as many ideas as possible in one session (Girotra, Terwiesch, & Ulrich 2010). The reasoning behind this is that by generating a higher quantity of ideas, there is a greater percentage of at least one of those ideas being good enough to continue to development. However, one of the problems with having so many ideas is that it becomes difficult to select which ones to move forward in the process of development. Not all companies have the resources to construct all ideas, so idea selection becomes especially important in the development of new products or ideas. This process is also important in processes outside of just brainstorming or initial development. Ideas are not simply generated and then selected, the process of developing ideas that continue through short proposals, full proposals, and final pitches all use methods of selection (Onarheim & Christensen 2012).

2.1 Selecting ideas

In order to select ideas for development and processing, ideas that have already been generated must be narrowed down to a manageable quantity (Netz 2017). One process that is used as a form of idea screening is called multivoting. This is a process in which individuals vote on the best item out of a selection of multiple items by placing a marker on that item. This process eliminates those items that don’t receive a vote, while keeping those items that receive high numbers of votes. Thus, ideas that receive multiple votes should be the ideas that move forward in the idea development process because they are the ones that are most popular and deemed to be the most desirable ideas.

Originality and feasibility are two common criteria that are considered when making a decision regarding the goodness of a creative idea (Diehl & Stroebe 1987). Original, or novel ideas are what most people think of when they think of a creative idea, but an idea that is just original without being feasible is simply erratic (Rietzschel, Nijstad, & Stroebe 2010). An idea must be appropriate and usable for the intended purpose, so a good creative idea (for a product or an engineering solution) must not only original but also feasible. Rietzschel et al. (2010) executed two studies in order to test how effective participants are at selecting good ideas from a group of possible ideas. In their first study, participants were instructed to generate ideas and then select their best idea. Half of the participants were specifically instructed to select the most original and feasible ideas, and the other half were simply instructed to select the best idea. Overall, results showed that participants tended to have poor judgement of creative ideas: they mostly selected feasible and desirable ideas over original ones despite half of participants having specific instructions to select original *and* feasible ideas. In their second study, Rietzschel et al. (2010) had participants choose from pre-generated ideas and instructed half of them to select the most creative idea and instructed the other half to select the best idea. Results from this study showed that those with the “creativity” criteria selected more original ideas than participants who were instructed to select “best’ ideas. People seemed to show a tendency to view the selection of feasible ideas as incompatible with the selection of original ideas, as they chose one over the other (the default was to choose feasible ideas over original ones). This is important as idea screening is considered to be a critical moment in deciding the fate of a creative idea. If non-experts are generally bad at judging the goodness of a creative idea, this could impact the success of potential ideas.

2.2 Bias in Crowd Voting/Selection

If examined on a macro level, the process of idea screening often does not involve just one person (Onarheim & Christensen 2012). Idea screening that utilizes the process of multivoting is similar to that of crowd voting (a form of crowdsourcing). Crowd voting takes ratings, votes, opinions or recommendations of the crowd into account for decision making as opposed to just taking the vote in the way that multivoting does (Leimeister 2012). A recent study on crowd voting on a popular hotel site shows that the sales of the hotel were directly impacted (positively) by the opinions of the crowd (Garrigos-Simon 2017). Even though crowd voting has more subjective opinions than multivoting, both of these processes share the act of having more than one person contribute to a decision. This stems from the concept of the “crowd-wisdom hypothesis”, which states that even if the individuals of a crowd are ignorant, overall, the judgement of the crowd as a whole will be relatively accurate (Simmons, Nelson, Galak, & Frederick, 2011). Of course, this can be a dangerous hypothesis, as it can easily lead to herd mentality and groupthink, however the implications that the crowd impacts the outcome of a particular event are important because it shows how intricately the users and the producers of products/services are intertwined.

Groupthink is a concept that originated in the early 70s by Irving Janis as a way to describe the "mode of thinking that persons engage in when concurrence thinking becomes so dominant in a cohesive in-group that it tends to override realistic appraisals of alternative courses of action" (Janis 1971). In other words, groupthink occurs when people make problematic decisions within a group because there is not enough diversity of thought to give an appropriate analysis of the situation. Janis even devised eight symptoms that, if present, are a clear indication that groupthink is likely to occur in a group. These symptoms include the illusion of invulnerability (members believe they can do no wrong), collective rationalization (members often try to rationalize why they should dismiss any warnings they receive), a belief in inherent morality (members may believe that their work is "for the greater good" and thus ignore any ethical ramifications), stereotyped views of out-groups (members have a negative view of those that are not part of their group), direct pressure on dissenters (members are pressured not to speak out against any other group member), self-censorship (any opinion that is not the majority is not expressed), the illusion of unanimity (members believe that everyone holds the same unanimous position on the topic), and mindguards (members will be self-appointed guards that attempt to keep out unwanted or contradictory information from the group leaders) (Janis 1971). These symptoms show that those who are subject to groupthink appreciate the group's cohesiveness over the necessary critical analysis of the actions of the group. While groupthink may not be a concern during multivoting (as groups do not discuss their votes), it is a concern during brainstorming. Lehrer summarizes findings by Alex Osborn, who, as previously mentioned, originally coined the term "brainstorming." According to Lehrer, Osborn claimed that working in groups made people more creative, yet one of his own studies showed contradicting results (Lehrer 2012). Osborn, as well as many follow up studies, displayed that working in groups caused people to be less creative, as they came up with fewer ideas. Yet, they worked *better* when working in groups. That is, they came up with more successful ideas when brainstorming in groups.

In order to test to see if biases occur during multivoting, whether related to gender or the first-cast votes, it is important to understand the patterns of voting behaviors that occur during idea screening. A common effect that occurs in voting behavior that is related to the "crowd-wisdom hypothesis" is the bandwagon effect. In the early 1990's, there was some discussion of whether the bandwagon effect truly existed, as most of the literature at the time had a clear electoral focus and did not reflect everyday life (Nadeau, Cloutier, & Guay 1993). The bandwagon effect, or agreeing with the majority for no reason other than the fact that it is the majority that has an opinion on something, was shown to strongly influence decisions through two experiments by Nadeau et al. (1993). Both experiments involved a panel and public opinion on two controversial issues: abortion and the constitutional future of Quebec. Results showed that for both of the issues, a strong bandwagon effect occurred regardless of the level of opinion crystallization on these issues. Another phenomenon similar to the bandwagon effect is conformity. In 1956, Solomon Asch executed a series of studies in which individuals were tested to identify how strongly they would adhere to the majority (Asch 1956). In the studies, participants were grouped with confederates, who knew the true purpose of the study but were presented as other participants in the group. The group was asked a series of questions regarding the length of a set of lines. For the first few questions, the confederates gave the correct answers, but then unanimously gave the wrong answer. The study tested how many participants would conform to the confederates' blatantly wrong answer, and how many stayed true to their beliefs. In all, 75% of participants followed the confederates and gave the wrong answer in at least one of the twelve trials (Asch 1956). In multivoting, it might be reasonable to suggest that people would choose to vote on the idea that received the early votes because they take comfort in following the crowd and trust that it has better judgement than themselves as individuals.

Another important factor to consider while focusing on voting behavior and possible bias is the fact that humans behave differently when presented with possible risk. This is connected to the bandwagon effect because the desire for people to follow the crowd stems from their unwillingness to stand out or take risks (Toh & Miller 2016). In idea screening, there is generally a higher risk in associating with novel ideas (Rubenson and Runco 1995). The perceived risk comes from the fact that novel ideas tend to have uncertainty attached to them regarding the overall possibility of success or failure (Moscovici 1976).

Kahneman and Tversky (1979) were the first major scholars to introduce the idea that humans are risk averse. Their paper, which gave a critique to the economic utility theory because it didn't involve risk aversion, claimed that people typically make decisions based on not just the usefulness (utility) of the choice, but also take into account how much of a risk the decision is, and if it is worth it. This is known as the Prospect Theory, and takes risk aversion into account by showing that people have a strong preference for certainty (opposite of risk). For example, if a person has two choices: a small amount of money that is offered with certainty, or a gamble of a higher amount of money, people will still pick the certain choice even though they're giving up some possible winnings to do so. Risk-taking and creativity are highly connected, since taking risks usually involves trying new things and stepping out of comfort zones (Kleiman 2008). These actions are common creative responses - the novelty of a creative idea mirrors the novelty of trying something new.

In idea screening, creativity and risk aversion are not typical connections that are explored together. Most of the research that focuses on risk aversion and creativity looks at how risk aversion impacts the idea generation stage, rather than the idea screening phase (Toh & Miller 2016). This is one of the reasons why examining bias is so important in idea screening: little is known about the potential factors that could impact a decision about a creative idea. However, given the information that is presented so far regarding risk aversion, crowd wisdom, and the bandwagon effect, it is possible to suggest that people might be more likely to behave a certain way while multivoting. They may be more likely to vote on an idea that has received the first vote because it poses less risk and would be contributing to following the crowd.

2.3. Visual Attention and Selection of Ideas

There is another factor that supports the idea of a possible first-cast vote bias in multivoting, and that is the mechanism of visual attention. While attention is a very complex mechanism, a brief explanation is that attention is a “form of mental activity or energy that is distributed among alternative information sources” (Friedenberg 2013). This means that while conscious, humans are constantly receiving visual information about the surrounding environment, starting from the eye and passing through to the primary visual or occipital cortex (Das, Bennett, & Dutton 2007). The information is then processed by the temporal lobe, which governs object recognition, and the parietal lobe, which takes the information and uses it to make decisions about visually guided movement (Das et at. 2007).

The role of visual attention becomes most important when discussing decision making during idea screening. Attention is described as a “family of processing resources or cognitive mechanisms that can modulate signals at almost every level of the visual system” (Evans, Horowitz, Howe, Pedersini, Reijnen, Pinto, Kuzmova, & Wolfe 2011). The mechanism of paying attention to a specific entity is considered a bottleneck system since at any given point in time, the resources allocated to cognitive processes are limited (Hitzel 2015). Overall, there are four basic purposes/features of visual attention: stimulus reduction, stimulus enhancement, binding, and recognition (Evans et al. 2011). While the existence of both stimulus reduction and enhancement may seem counterintuitive, it comes from the fact that attention to one specific item dulls the processing of other items, thus filtering out environmental information that the brain must process. Likewise, by attending to one specific item, the visual features of that item are enhanced during processing. Binding refers to the problem that occurs when looking at how we manage to perceive all of the different characteristics of the world around us such as shape, color, motion, size and distance without getting them mixed up (Treisman 1998).

Visual attention is used for object recognition as well. Essentially, the brain's functions that are responsible for object recognition cannot handle recognizing *every* object at the same time, so visual attention allows the system to filter what is important to recognize in the moment (Evans et al. 2011). Studies involving attention and decision making are often focused around a concept called the gaze bias. When given a choice of a few stimuli, participants' gaze lingered on the stimulus that they would eventually choose even before they decided to select it (Saito, Nouchi, Kinjo, & Kawashima 2017). Another study by Glaholt & Reingold (2009) used eye tracking technology to demonstrate a strong bias towards a chosen item in both gaze duration and gaze frequency. This added information about the visual attention system supports the suggestion that when an idea receives a vote first, participants' attention is brought to and focused on that idea. It is possible that a gaze bias could interfere with the decision making process in multivoting, which would lead to the first-voted ideas having more overall votes.

2.4 Gender Bias is Idea Selection

When looking at specific influences that relate to a gender bias in past research, it is important to note that many studies have examined decision making and confidence in multiple different settings. These include a university setting (Jakobsson 2012), in mathematics (Dahlbom, Jakobsson, Jakobsson, & Kotsadam 2011), in economic investments (Estes and Jinos 1988), and in sports (Wolfson and Neave 2007). The results of these situations have been similar; men are overall more confident than women. However, it is interesting to specify that in situations such as school children learning math, it is not *just* that males are more confident than females, but that females are under confident overall (Dahlbom et al., 2011). This indicates that it is not *only* men's confidence levels that are an issue, but both men and women's confidence levels. In 1998, Estes and Jinos explored the gap in confidence between men and women in regards to investment decisions. They found that "women had significantly lower confidence in an investment task than men." This was an important finding of the time, since it contradicted previous literature, which typically claimed that it was people in general (not a specific gender) that are overconfident in judgements (Slovic, Fischhoff, & Lichtenstein, 1977). Confidence can be something that can make or break a choice, especially if social pressure is added to the mix. Sara Mills, author of "Gender and Politeness" explains that there are definitely circumstances when women act in a more polite way than men, which comes from stereotypes of femininity (2003). However, Mills argues that there are also plenty of circumstances where women will act just as impolitely as men. Overall, the literature on multivoting and decision making is lacking information regarding a gendered confidence bias. If men are more likely than women to vote on their own ideas during multivoting, it could relate to their higher levels of confidence.

Another possibility that could suggest men being more likely to vote on their own ideas than women is a known ownership bias. This occurs when the owner of an idea experiences an increased attachment to that idea and it has been shown to impact the selection process (Cooper, Edgett, & Kleinschmidt 2002). However, there are other factors that augment the attachment to a person's own ideas. People tend to have stronger perceptions of themselves compared to perceptions of other people (Toh, Strohmetz, & Miller 2016). This combined with the higher confidence and self esteem levels in males (Kling, Hyde, Showers, & Buswell 1999) could lead to the possibility of males having a higher tendency to exhibit an ownership bias. Previous studies done on engineering design students did indeed indicate that male design students displayed an ownership bias whereas female students "displayed the opposite of ownership bias, or what has been referred to as the Halo Effect" - they selected more of their teammates' ideas than their own ideas (Toh, Strohmetz, & Miller 2016). The use of the term "Halo Effect" by derives from the concept of (sometimes incorrectly) generalizing certain characteristics from one domain to a separate unrelated domain. Toh et al. explained that females may have evaluated idea goodness based on characteristics such as age, major, and gender, hence why the results of them choosing their teammates' ideas has been referred to as the Halo Effect.

Another well-known difference between males and females in the literature is the difference in empathy between genders. According to Rosalind Dymond, empathy is split up into two main components: emotional empathy and cognitive empathy. This is the ability to take the role of another person and the ability to understand/predict that person's internal thoughts and feelings, respectively (Mehrabian, Young, & Sato 1988). Another way of explaining this split is by understanding that cognitive empathy involves understanding how a person is feeling, while emotional empathy involves actually feeling it for oneself (Rueckert & Naybar 2008). In terms of gender and empathy, Reuckert and Naybar's study showed that when given the Mehrabian and Epstein Empathy Questionnaire (MEEQ) men had a mean score of 21.95 and women had a mean score of 40.48, which is statistically significantly higher. The fact that men may have lower empathy could be important to the current study, because a lack of empathy could be connected to males being more likely to vote on their own ideas since they have less ability to sense that voting on an own idea could be considered to some to be a selfish act.

3.0 Research Questions

3.1 Gender

There are two main sets of biases (gender and first-cast-vote bias) that we are investigating in this work, each with their own questions below. Based on previous research regarding confidence levels, males having higher self esteem than females, and males having lower empathy levels than females, it is hypothesized that if presented with a mix of self-generated and team/classmate-generated ideas, males are more likely than females to vote for their own ideas in a multivoting scenario. We pose two separate questions regarding a gender bias:

1) Do males vote on their own ideas more often than females in a team based multivoting session? That is, given the opportunity to multivote in a team based setting, will males place more physical votes on one of their own ideas than females?

2) Do males have more self-voted ideas than females? That is, given the opportunity to multivote in a team based setting, will males vote on more of their own ideas than females? This question is focused on the ideas themselves, while the previous question is focused on the votes, not the ideas. It is possible to place more than one vote on a person's own idea, so the second question addresses the distribution of self-votes on self-created ideas.

3.2 First-Cast Votes

Another portion of this investigation is devoted to looking at a bias toward the the first ideas that receive votes in the multivoting process. Based on literature detailing gaze bias, the bandwagon effect, and risk aversion tendencies, we hypothesize that an idea that receives an initial vote is more likely to have a higher number of votes than other ideas. The specific research question is:

1) Do the first-voted ideas (the first three ideas to receive any vote) have statistically more votes than other ideas with votes?

4.0 Study 1

4.1 Participants and Materials

This study included 109 participants from an undergraduate Creative Design Methods class. There were 49 males and 57 females. For the purposes of the gender portion of the study, we limited the genders to a binary: male and female. One participant listed "other" as their gender, and two participants did not disclose a gender, thus all three of their data were not included in this study. A total of 106 participants were considered for this study. For the purposes of the first-cast vote portion of the study, the three participants that did not indicate a gender were not omitted since gender is not taken into account in the first-cast-vote data analysis, so all 109 participants were considered for analysis. Participants were grouped randomly into 16 groups, made up of six or seven students. The groups were created for a general class project. Groups had an even distribution of males and females (teams of 7 had an extra male). Upon arriving to class, students were given pre-labelled notepads (6x8 inch, unruled, colored, Post It notes with adhesive) that had their ID number on the back of each individual sheet in the pad. Other materials for the study included sticker packs (12 white, ¾ of an inch in diameter, dot stickers per pack) that were given to each student to be used in the multivote. Each sticker dot was labelled with the participant's ID number and would represent one vote. The students were not aware that the dots corresponded to their personal ID. Each group also had their own facilitator. Facilitators were prepared in the same way – they were given the same instructions of how to conduct the brainstorming session, how to deliver the prompt, and how to conduct the multivote. They were instructed not to critique the ideas.

4.2 Methods and Analysis

Participants were assigned ID numbers in advance so that we could discriminate between ideas of students. Sticker packs were prepared prior to the study by labelling each sticker pack with assigned ID numbers. Students were grouped into sections of six or seven. Seating was thus chosen by group, in accordance to how the class was organized, not for any purpose of this study. Teams were seated at round tables, in accordance to how the class was organized. During class, participants were asked to create as many ideas as possible in ten minutes to fulfill the prompt of ways to get kids to eat vegetables. Students used the pre-labelled notepads that had their ID number on the back of each sheet in order to draw their ideas.

After the ten minutes were up, students presented their ideas to the team by attaching their idea drawings to a wall surface with tape. After all ideas were placed on the wall, students were given their assigned sticker packs.

Students were instructed to participate in a silent multi-voting process in which all participants received the same amount of white stickers (10) and approached the wall of ideas at the same time (See Figure 1). The students were then told they can place their (10) dots on any ideas they felt were the strongest product concepts for the theme (ways to get kids to eat vegetables).

Figure 1. Students Participating in the Multivote.

Participants could allocate their stickers however they saw fit. There was no limit to how many of their sticker votes they could use on an idea. They were told they could vote on their own ideas and that they could not vote outside of their group. During the voting process, research facilitators would keep track of the first three ideas to receive votes by watching from a distance. After all voting was complete, facilitators would mark the first three ideas with a star so that they could easily be identified during analysis.

For the gender portion of the study, the data were organized by keeping track of the participant ID and recording how many ideas they produced, how many votes they received across all of their own ideas (how many total stickers they received), the number of ideas that received any vote, how many times they voted on their own ideas (the number of stickers on their ideas in which the ID number on the sticker matched with the ID on the back of the idea), how many of their own ideas they self-voted on (the number of ideas which had stickers with matching ID numbers), and the gender of the participant.

For the first-cast-vote portion of the study, every idea was recorded individually, keeping track of the number of votes on that idea and if it is a starred idea (indicating it is one of the first three ideas that received a vote). Participant information was recorded separately, keeping track of how many of their ideas were starred, how many total votes they received, and how many of their ideas received any votes.

The gender data were then analyzed by completing an independent t-test to compare the average number of self-votes between males and females, the number of ideas that were produced that received any self votes between males and females, the average number of total ideas produced by males and females, and the average number of total votes they receive on all of their ideas. The first-cast-vote data were analyzed by performing an independent t-test to compare the average number of votes between starred ideas with votes, non-starred ideas with votes, and ideas overall. Also, a repeated measures ANOVAs to compare the average votes per starred idea against the average votes per voted idea separated by group. This was done because white the groups were not created for this study, it is important to examine any differences between groups. Again, the starred ideas were those that were marked as being one of the first three to receive a vote on that specific team.

4.3 Results

On average each team generated 107.37 ideas in the 10 minutes. On average each person generated 16.21 ideas in the 10 minutes. When looking at the number of ideas produced by each team, Team 9 appeared to have a much higher average than the rest of the teams, as seen in Figure 2. The average number of ideas produced for Team 9 was 24, which is almost five more than the average of the next-highest number of ideas produced (Team 4, with an average of 19.85). After running an ANOVA, it is apparent that there are statistical differences regarding the total number of ideas produced between teams ($F(15,90) = 1.84$, $p = .040$). Upon further examination of the data, every participant in Team 9 has a higher number of ideas produced than the average, with three out of seven cases being more than one standard deviation above the mean.

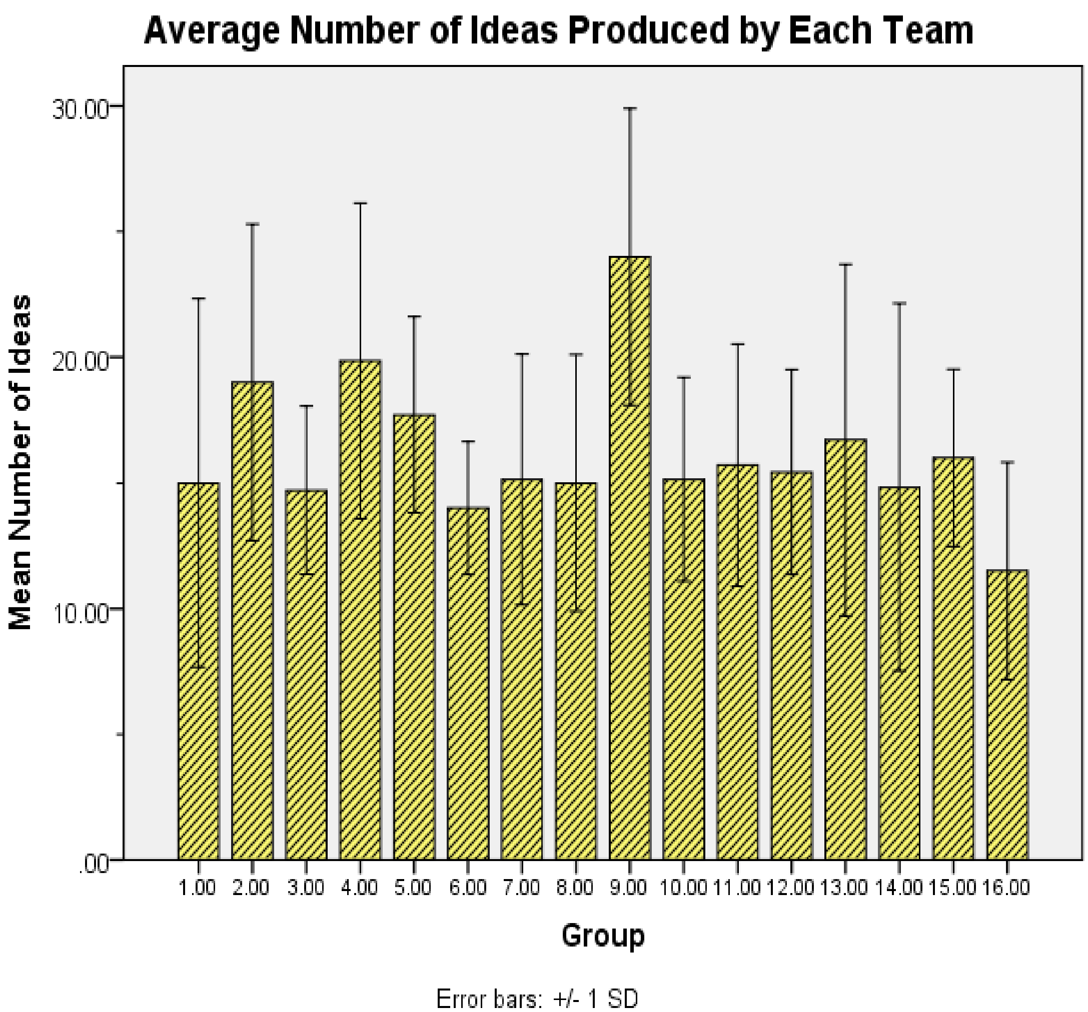


Figure 2. Average Number of Ideas Produced by Each Team

For the gender portion of the study, there was no statistically significant difference between males (M=2.14, SD=1.99) and females (M=1.75, SD=1.36) and the average number of times they voted on their own ideas, t(104)=1.18, p=.239. There is also no statistically significant difference between males (M=2.04, SD=1.74) and females (M=1.71, SD=1.28) and the average number of ideas they self-voted on, t(104)=1.09, p=.277. These results indicate that while there is a slight difference between males and females on both the number of self votes (Figure 3) and self-voted ideas (Figure 4), there is not enough of a difference to be considered a “gender bias.” Other comparisons were examined such as the difference between the average number of total ideas produced by males (M=15.75, SD=5.36) and by females (M=16.59, SD=5.70). Results indicated no difference between males and females, t(104)=-.778 , p=.438. Finally, there is no difference between males (M=10.69, SD= 5.83) and females (M=9.10, SD=5.24) and the average number of total votes they receive on all of their ideas, although the results indicate that the relationship is nearing significance, t(104)=1.47 , p=.143. Figure 5 represents number of total votes received on male and female ideas.

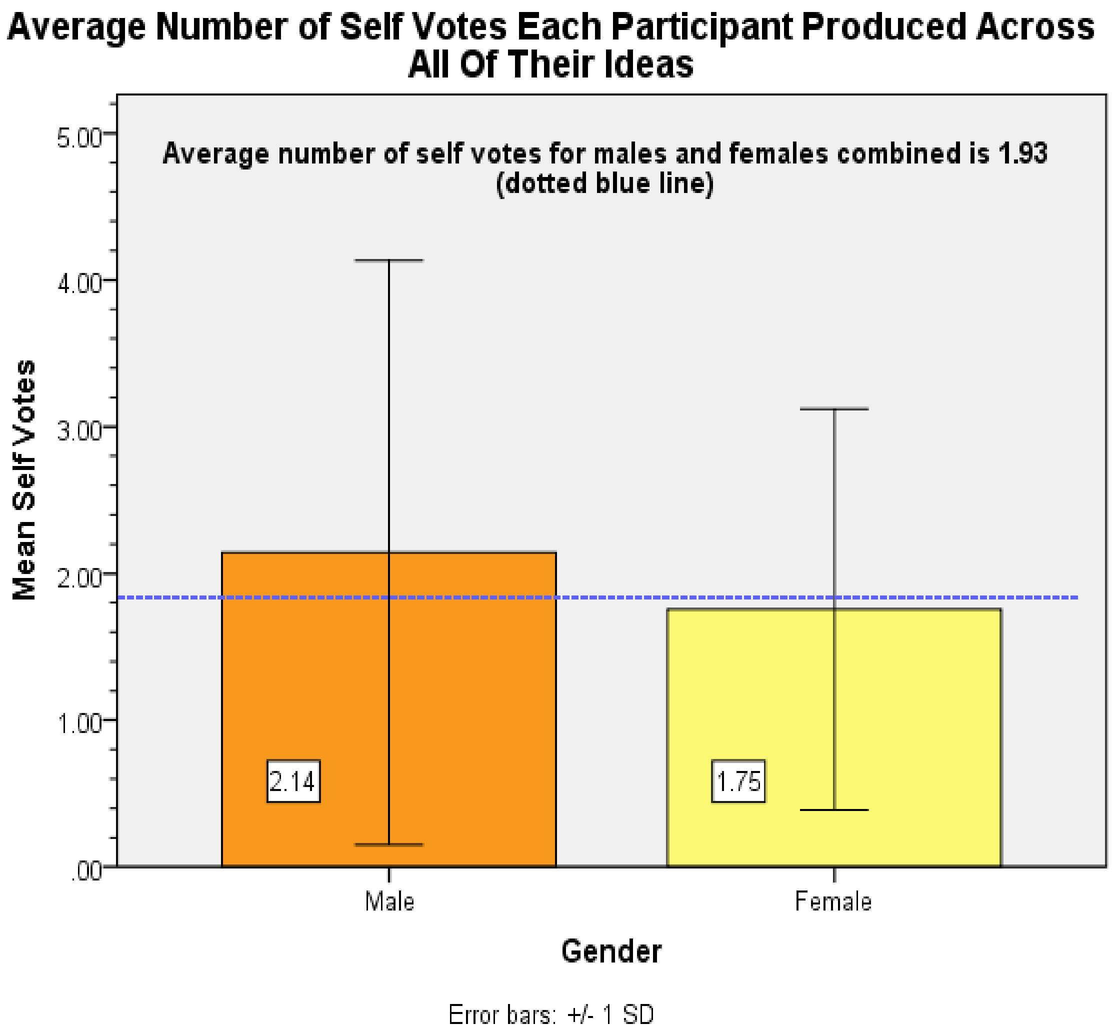


Figure 3. Average Number of Self Votes Each Participant Produced Across All of Their Ideas

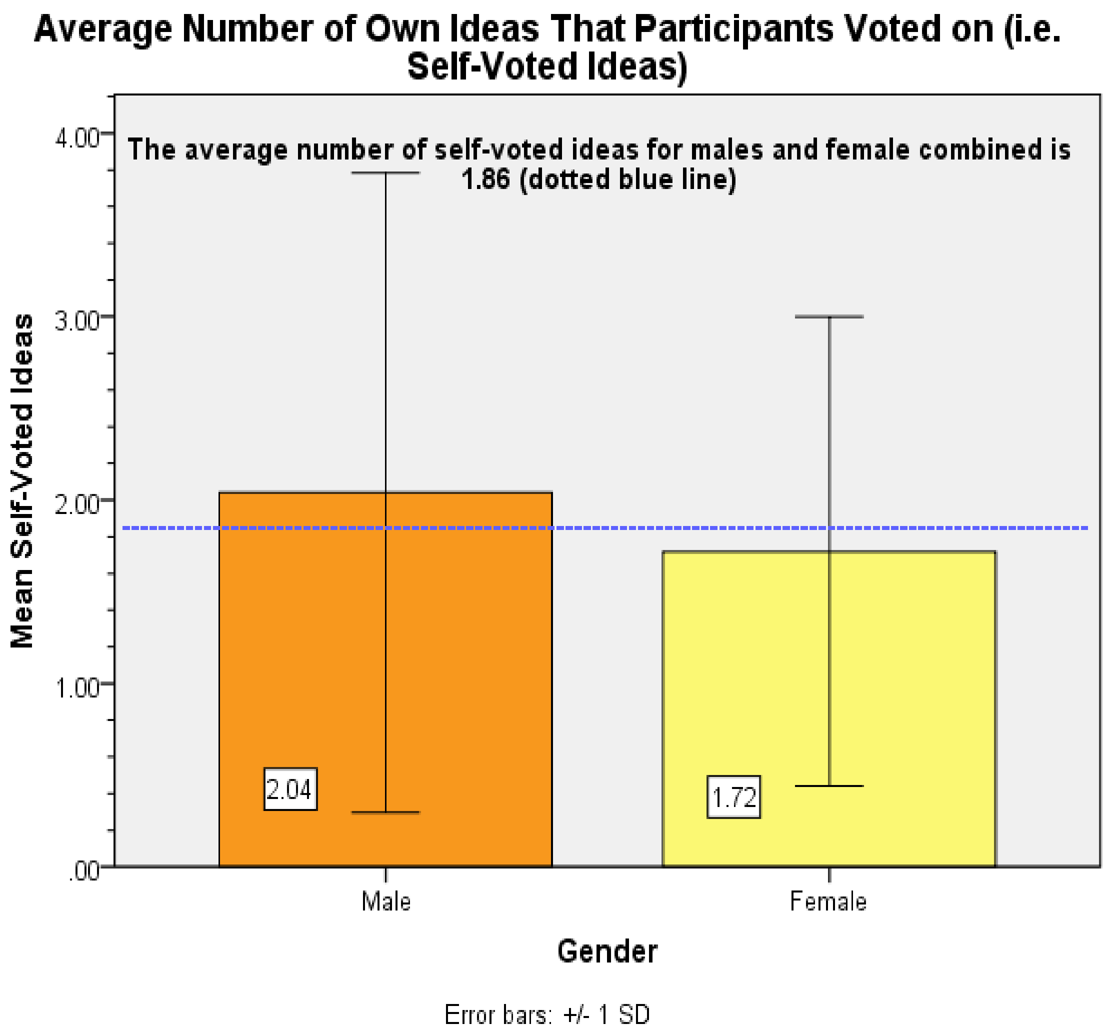


Figure 4. Average Number of Own Ideas that Participants Voted on (i.e.Self Voted Ideas)

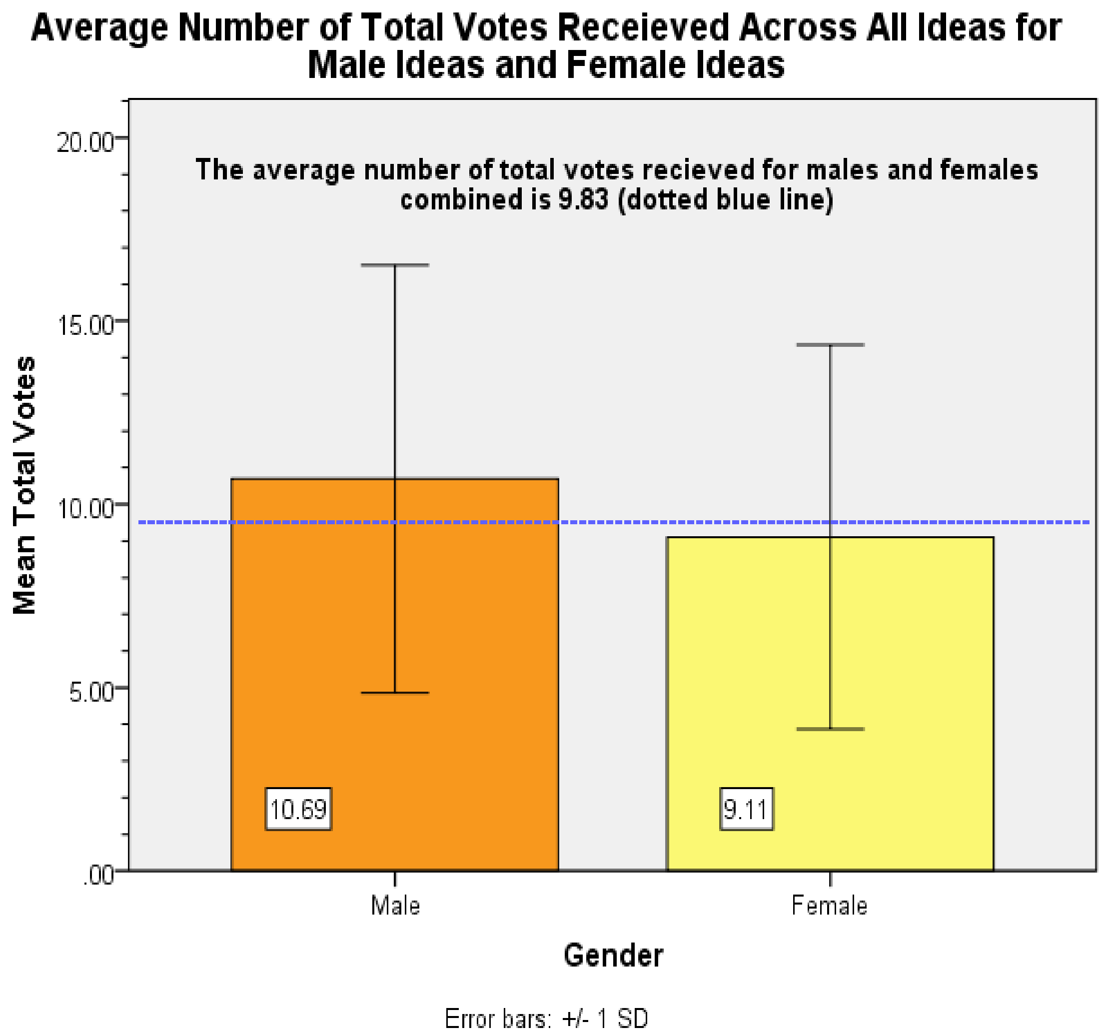


Figure 5. The Average Number of Total Votes Received Across All Ideas for Male and Female Ideas

For the first-cast-vote portion of the data, in order to accurately see if there was a statistically significant difference in average number of votes (per voted idea) between first-voted ideas and non-first-voted ideas, all ideas which received no votes were excluded. This prevents the average from being affected by the 1,124 ideas that did not receive any votes. Also, Group 5 only marked one idea with a star, so the group was also excluded. Results show that there is a statistically significant difference in average number of votes received between first-voted ideas (M=3.20, SD=1.66) and non-first-voted-ideas-that-received-votes (M=1.78, SD=1.14), $t(48.01) = -5.60$, $p < .001$.

The first-voted ideas received on average almost twice as many (1.8 times more) votes as the non-first-voted-ideas-that-received-votes (Figure 6). For all teams combined (minus Group 5), there were a total of 1002 votes spread out among 1650 ideas, which leads to an average of 0.61 votes per idea, for all ideas, first-voted or not first-voted (Figure 7). Another way of viewing this is that if all votes were distributed equally, each idea would get on average 0.61 votes. On average, 14.87% of the total votes went to just the first three ideas that received votes.

To analyze the mean differences of the average votes per voted idea (M = 1.92, SD = .25) vs the average votes per starred idea (M = 3.07, SD = .92), a repeated measures ANOVA analysis was completed. There was a significant difference between groups at the $p<.01$ level for the 16 groups, [$F(1, 15) = 31.63$, $p<.001$]. This indicates that groups had statistically significantly different averages of votes for first-voted ideas and the non-first-voted-ideas-that-received-votes.

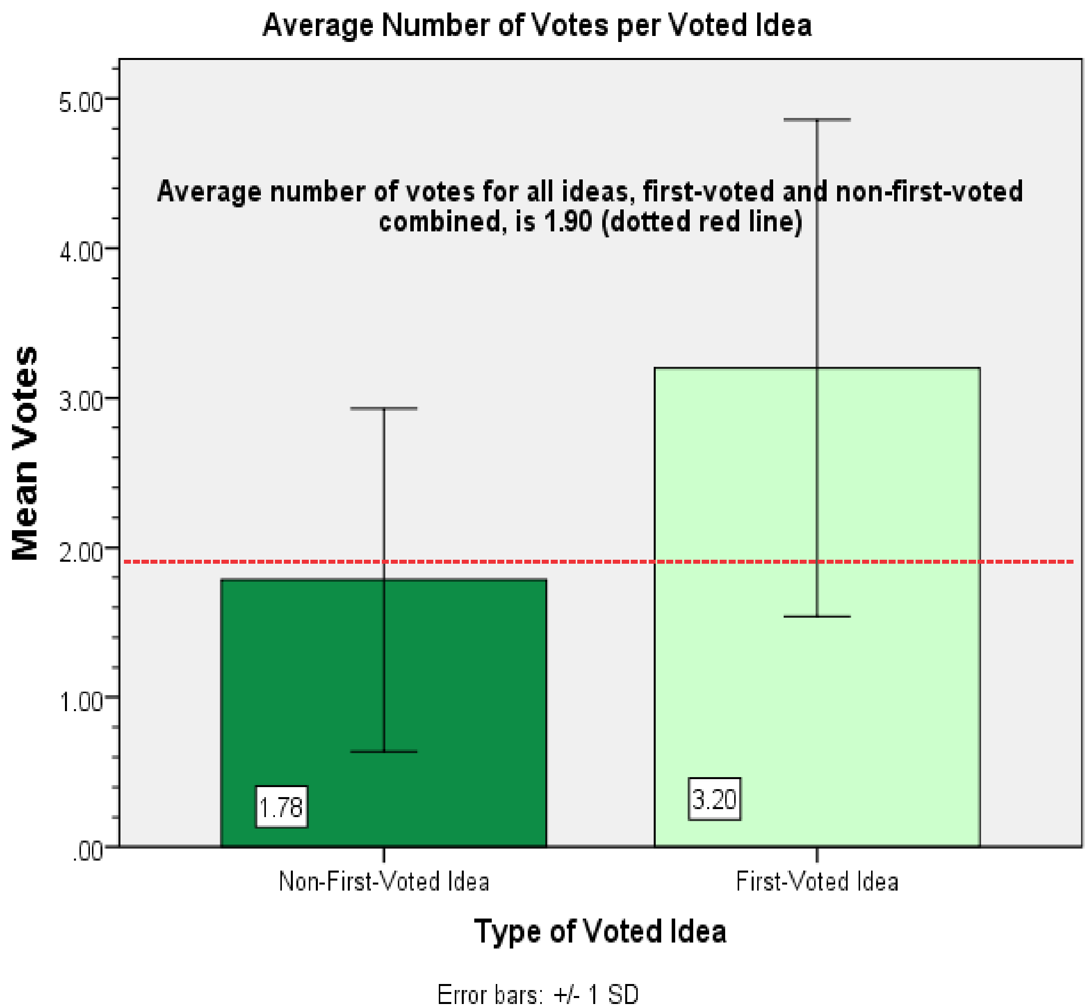


Figure 6. Average Number of Votes per Voted Idea

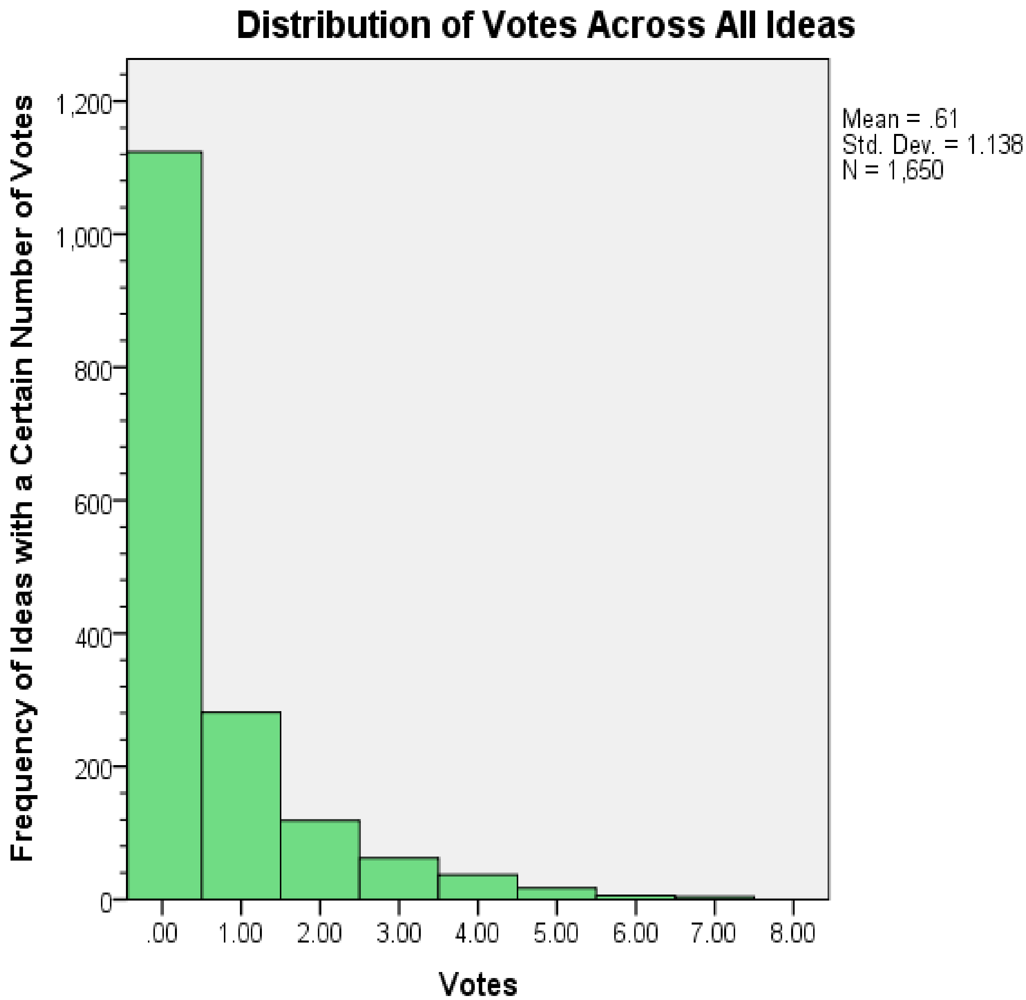


Figure 7. Distribution of Votes Across All Ideas

5.0 Study 2

5.1 Participants and Materials

This study also included 109 participants from the same undergraduate Creative Design Methods class. Study 2 took place roughly 3 weeks after Study 1. There were 49 males and 57 females. For the purposes of the gender portion of the study, we limited the genders to a binary: male and female. One participant listed “other” as their gender, and two participants did not disclose a gender, thus all three of their data were not included in this study. There were also three members who had incomplete data, possibly from being absent from class. These were also omitted, leaving a total of 103 participants considered for this study. For the purposes of the first-cast vote portion of the study, the three participants that did not indicate a gender were not omitted since gender is not taken into account in the first-cast-vote data analysis, so 106 participants were analyzed in total. Participants were grouped randomly into 16 groups, made up of six or seven students. The groups were created for a general class project and were the same as the groups from the previous study. Groups had an even distribution of males and females (teams of 7 had an extra male). Instead of being given a notepad to generate ideas in class, students came to class equipped with ten sketches of ideas to fit the prompt of “creative product solutions related to organization” that they had previously worked on during brainstorming sessions as a homework assignment. The 10 ideas each student brought in were the best self-selected concepts from their homework. Other materials for the study included sticker packs (12 colored (red, yellow, green, blue), ¾ of an inch in diameter, dot stickers per pack) that were given to each student to be used in the multivote. Each sticker dot was labelled with the participant's ID number and would represent one vote. The students were not aware that the dots corresponded to their personal ID. Examples of some of these ideas on post it notes are shown in Figure 8. Each group also had the same facilitator as the previous study, and they were all prepared in the same manner. They were given instructions on how to conduct the multivote with the already prepared ideas from students.

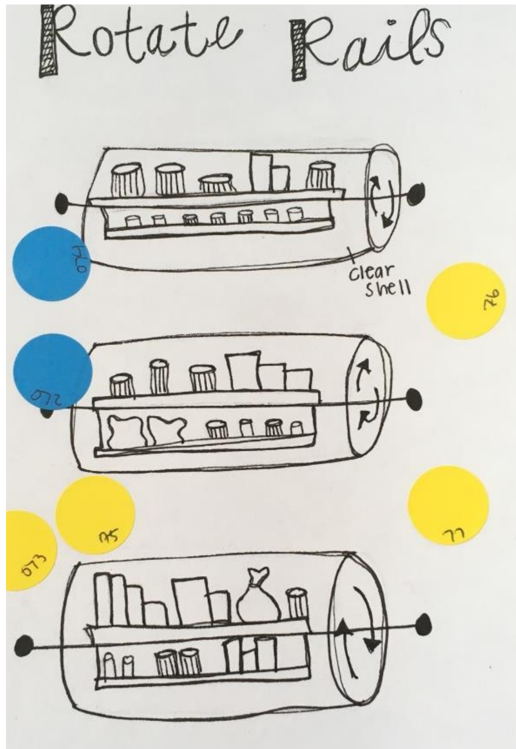


Figure 8. Example of Idea With Sticker Dots On It

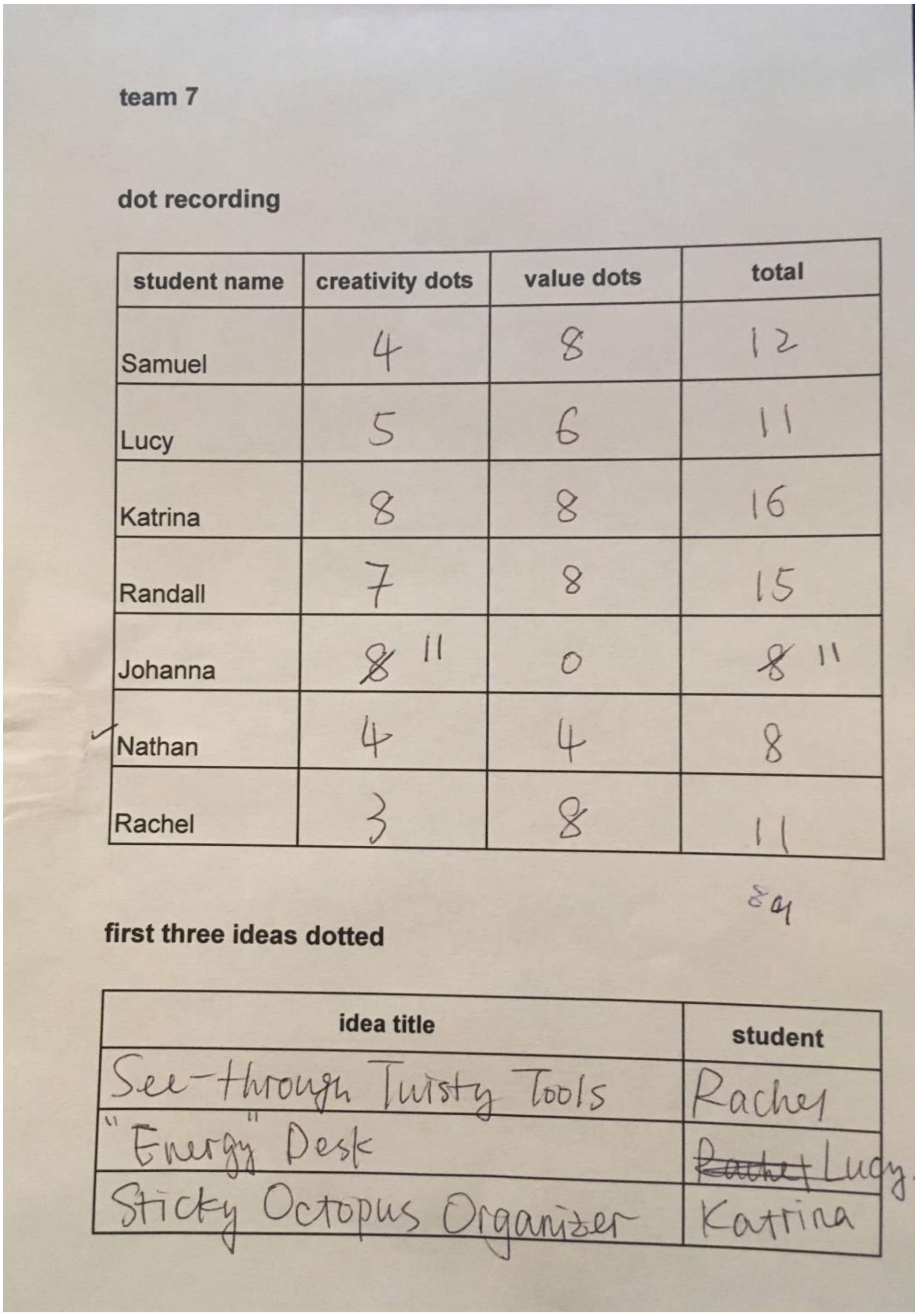
5.2 Methods and Analysis

Participants were assigned ID numbers in advance so that we could discriminate between ideas of students. Sticker packs were prepared prior to the study by labelling each sticker pack with assigned ID numbers. Sticker packs were created as groups of either blue and yellow dots or red and green dots. Each student would receive 6 sticker dots of one color and 6 of the second in each pack. There was no mixing of the colors; every group had the same color combination in their sticker pack. For example, every member of Group One would receive the blue and yellow sticker pack, while every member of Group Two would receive the red and green sticker pack. Students were grouped into sections of six or seven. Seating was thus chosen by group, in accordance to how the class was organized, not for any purpose of this study. Before class, participants were asked to create ten ideas for creative product solutions for organization as a homework assignment.

Students presented their 10 ideas to the team by attaching their 10 idea drawings to a wall surface with tape. After all ideas were presented to the team, students were given their assigned sticker packs.

Students were instructed to participate in a silent multi-voting process in which all participants would receive the same amount of stickers (12) and approach the wall of ideas at the same time. The students were then told that the red and yellow sticker dots would represent value and the blue and green sticker dots would represent creativity. The use of value and creativity dots was for the purposes of another project occurring at the same time, and would be disregarded later in this study. Students were told they could place their (12) dots on any ideas they feel are the strongest representation of those two characteristics (value and creativity) for the theme of product solutions for organization.

Participants could allocate their stickers however they saw fit. There was no limit to how many of their sticker votes they could use on an idea. They were told they could vote on their own ideas, however students could not vote outside of their group. During the voting process, research facilitators would keep track of the number of value dots and creativity dots on each participants' ten ideas and the first three ideas to receive votes by watching from a distance. After all voting was complete, facilitators would mark the first three ideas with a star so that they could easily be identified during analysis. They also filled out a small table that easily kept track of the number of creativity and value dots for each participant (see Figure 9).



team 7

dot recording

student name	creativity dots	value dots	total
Samuel	4	8	12
Lucy	5	6	11
Katrina	8	8	16
Randall	7	8	15
Johanna	~~8~~ 11	0	~~8~~ 11
✓ Nathan	4	4	8
Rachel	3	8	11

84

first three ideas dotted

idea title	student
See-through Twisty Tools	Rachel
"Energy" Desk	~~Rachel~~ Lucy
Sticky Octopus Organizer	Katrina

Figure 9. Facilitators’ Sheet To Keep Track Of Dots

For the gender portion of the study, the data were organized by keeping track of the participant ID and recording how many votes they received across all of their own ideas (how many total stickers they received), how many times they voted on their own ideas (the number of stickers on their ideas in which the ID number on the sticker matched with the ID on the back of the idea), the gender of the participant, and the number of ideas that received any votes.

For the first-cast-vote portion of the study, every idea was recorded individually, keeping track of the number of votes on that idea and if it is a starred idea (indicating it is one of the first three ideas that received a vote). Participant information was recorded separately, keeping track of how many of their ideas were starred, how many total votes they received, and how many of their ideas received any votes. For both the gender portion of the study and the first-cast-vote portion, the color of the dots was disregarded. The votes were counted as if all dots were the same color.

The gender data were then analyzed by completing an independent t-test to compare the average number of self-votes between males and females and the number of ideas that were produced that received any self votes between males and females (i.e. self-voted ideas). The first-cast-vote data were analyzed by performing an independent t-test to compare the average number of votes between first-voted ideas with votes and non-first-voted ideas with votes.

5.3 Results

For the gender portion of the study, there was no statistically significant difference between males ($M=1.29$, $SD=1.32$) and females ($M=.964$, $SD=1.02$) and the number of times they voted on their own ideas, $t(101)=1.42$, $p=.158$ (Figure 10). There is also no statistically significant difference between males

(M=1.25, SD=1.24) and females (M=.964, SD=1.02) as far as the number of ideas they self-voted on, t(101)=1.28, p=.202 (Figure 11). These results indicate that while there is a slight difference between males and females on both the number of self votes and self-voted ideas, there is not enough of a difference to be considered a “gender bias.” Other comparisons were examined such as the difference between males (M=11.93, SD= 4.15) and females (M=12.09, SD=4.20) and the average number of total votes they receive on all of their ideas, t(101)=-.186 , p=.853 (Figure 12).

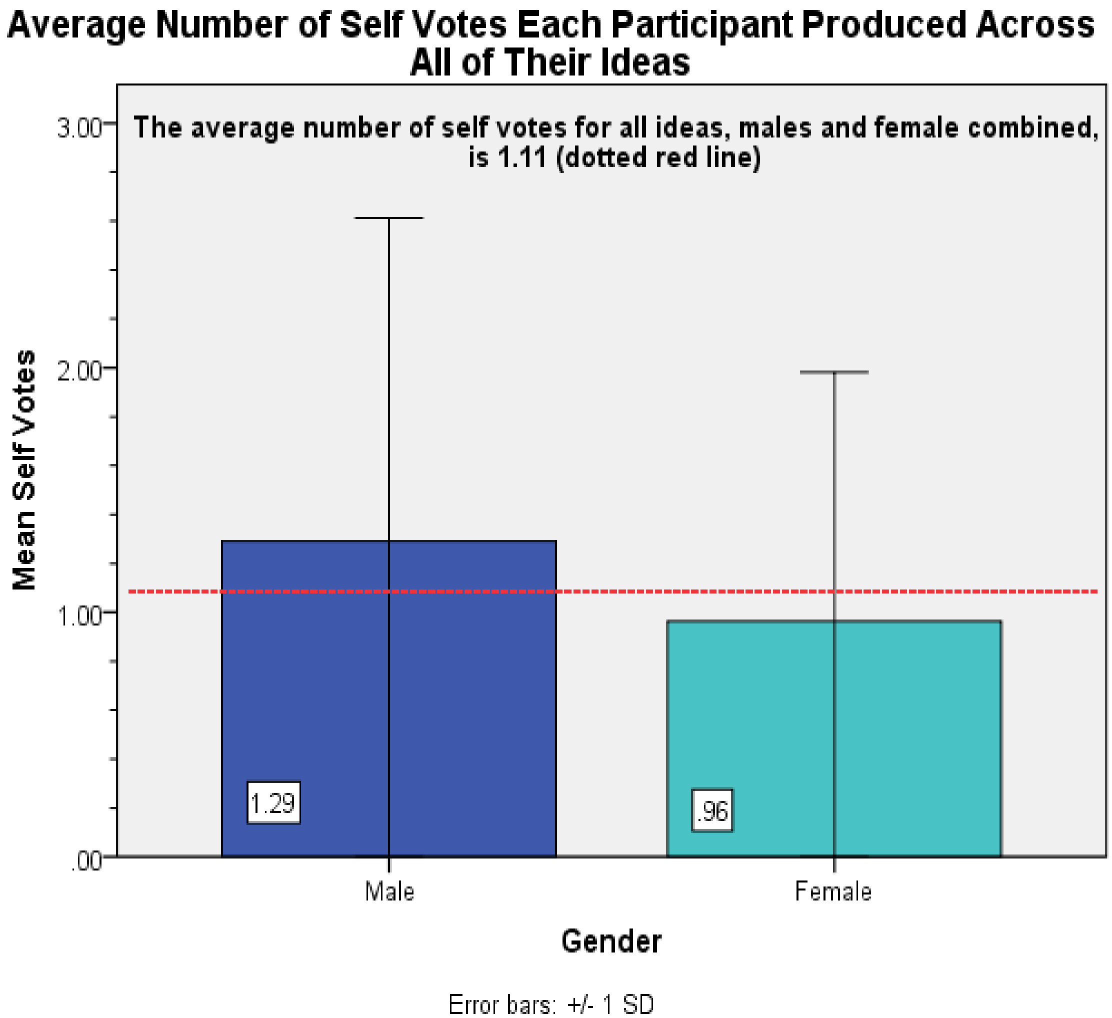


Figure 10. Average Number of Self Votes Each Participant Produced Across All of their Ideas

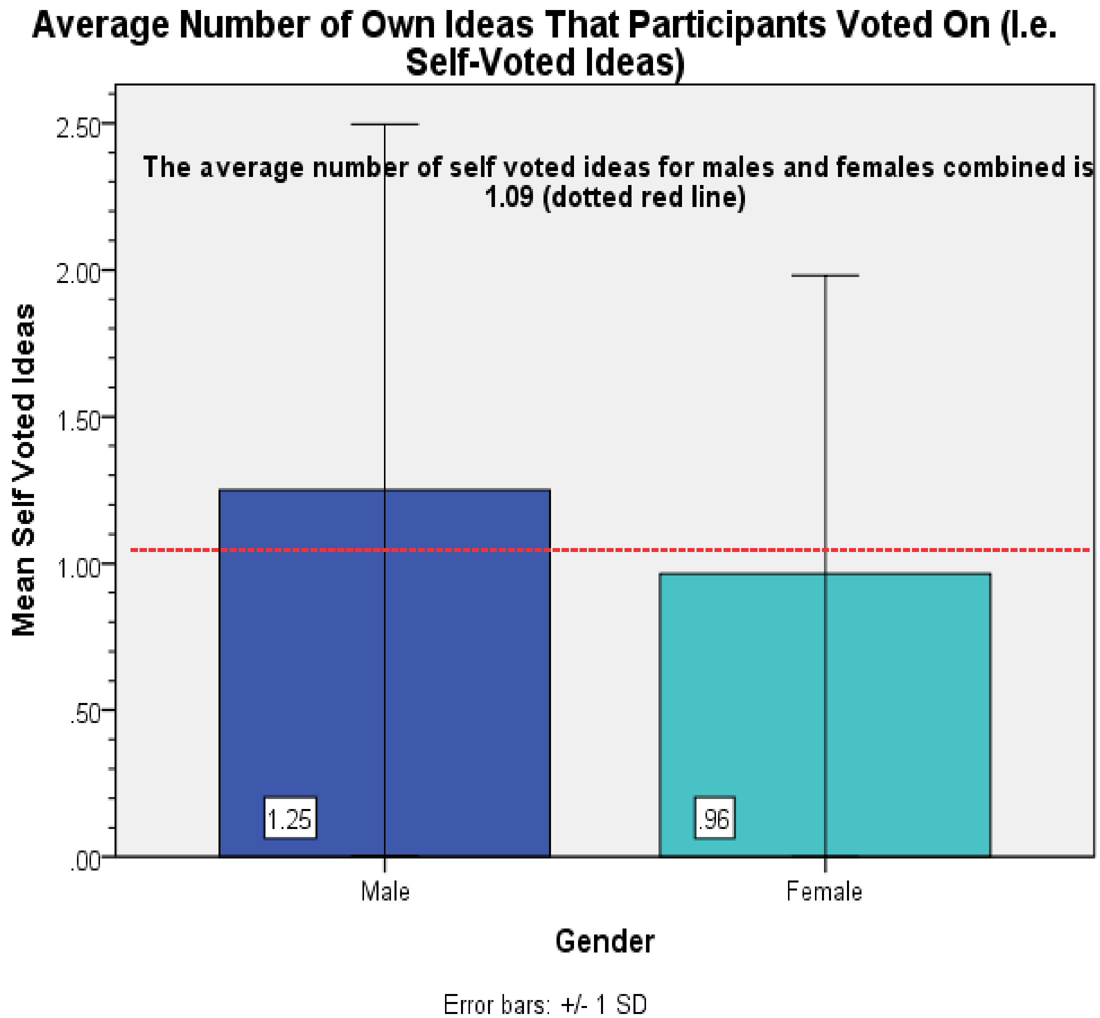


Figure 11. Average Number of Own Ideas Each Participant Voted On (i.e Self Voted Ideas)

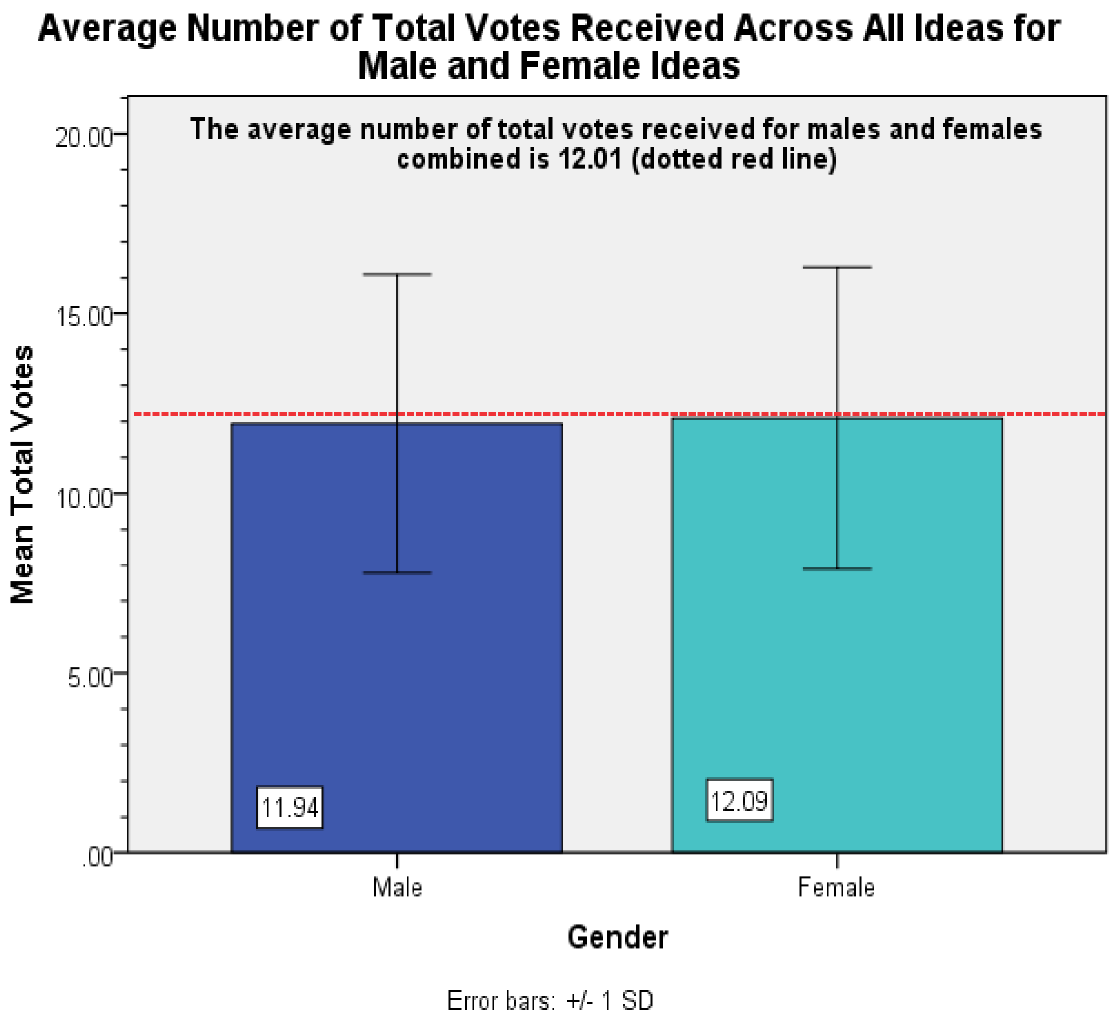


Figure 12. Average Number of Total Votes Received Across All Ideas for Male and Female Ideas

As for the first-cast-votes, in order to accurately see if there was a significant difference in average number of votes (per voted idea) between first-voted ideas and non-first-voted ideas, all ideas which received no votes were excluded. This prevents the average from being affected by the 455 ideas that did not receive any votes. There was a statistically significant difference in average votes (per voted idea) between first-voted ideas (M=3.61, SD=1.80) and non-first-voted-ideas-that-received-votes (M=1.96, SD=1.26), $t(46.374) = -5.946$, $p < .001$. The first-voted ideas received on average almost twice as many votes (1.8 times more) as the non-first-voted-ideas-that-received-votes (Figure 13). There were a total of 1262 votes spread out among 1061 ideas for all of the teams combined, which leads to an average of 1.18 votes per idea, for all ideas, first-voted or not-first-voted (Figure 14). If all votes were distributed equally, each idea would get on average 1.18 votes. The first-voted (3) ideas per team received 3.55 votes on average, and 12.6% of the total votes went to just the first three ideas that received votes on each team.

To analyze the mean differences of the average votes per voted idea (M = 2.13, SD = .39) vs the average votes per starred idea (M = 3.68, SD = 1.37), a repeated measures ANOVA analysis was completed. There was a significant difference between groups at the $p<.01$ level for the 16 groups, [F(1, 15) = 26.88, p < .001]. This indicates that groups had statistically significantly different averages of votes for first-voted ideas and the non-first-voted-ideas-that-received-votes.

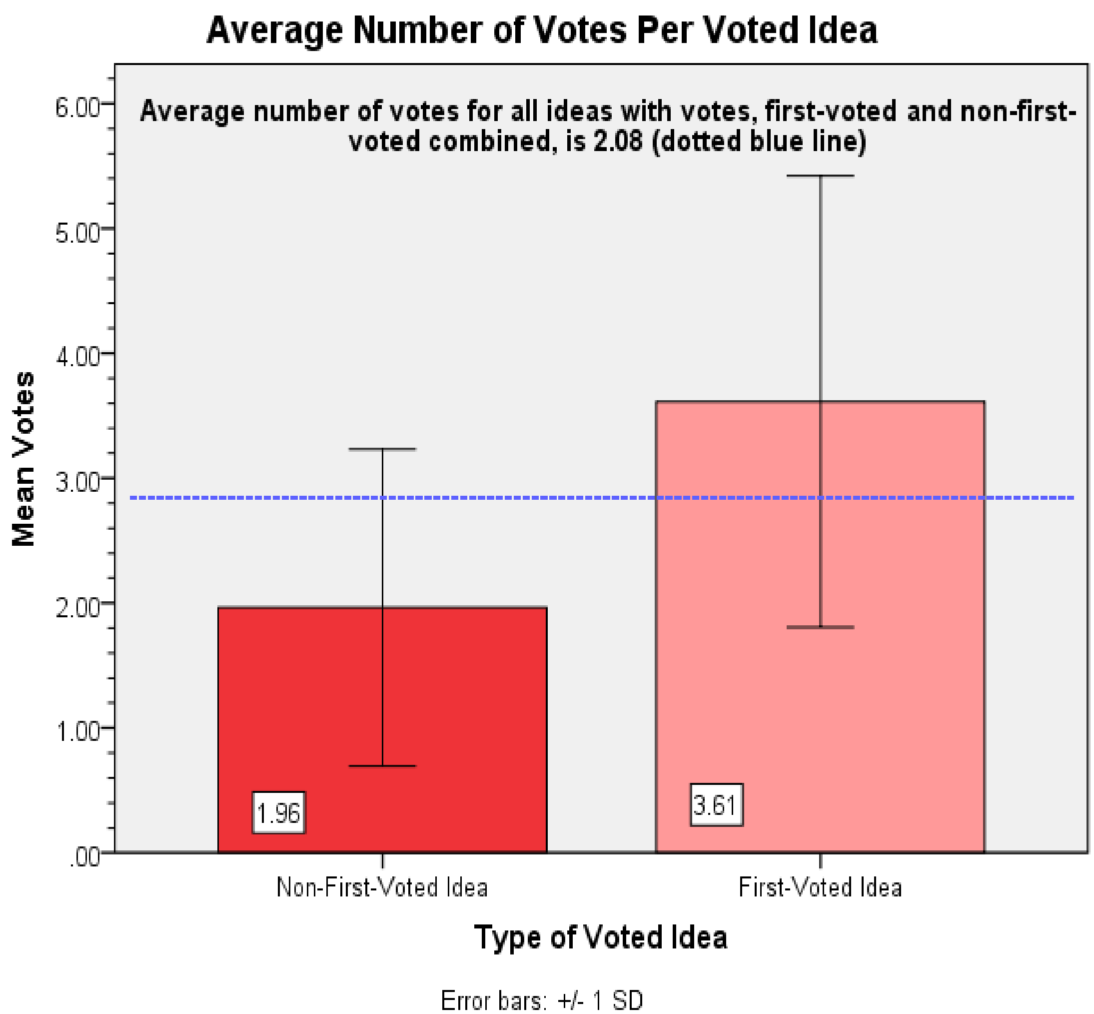


Figure 13. Average Number of Votes Per Voted Idea

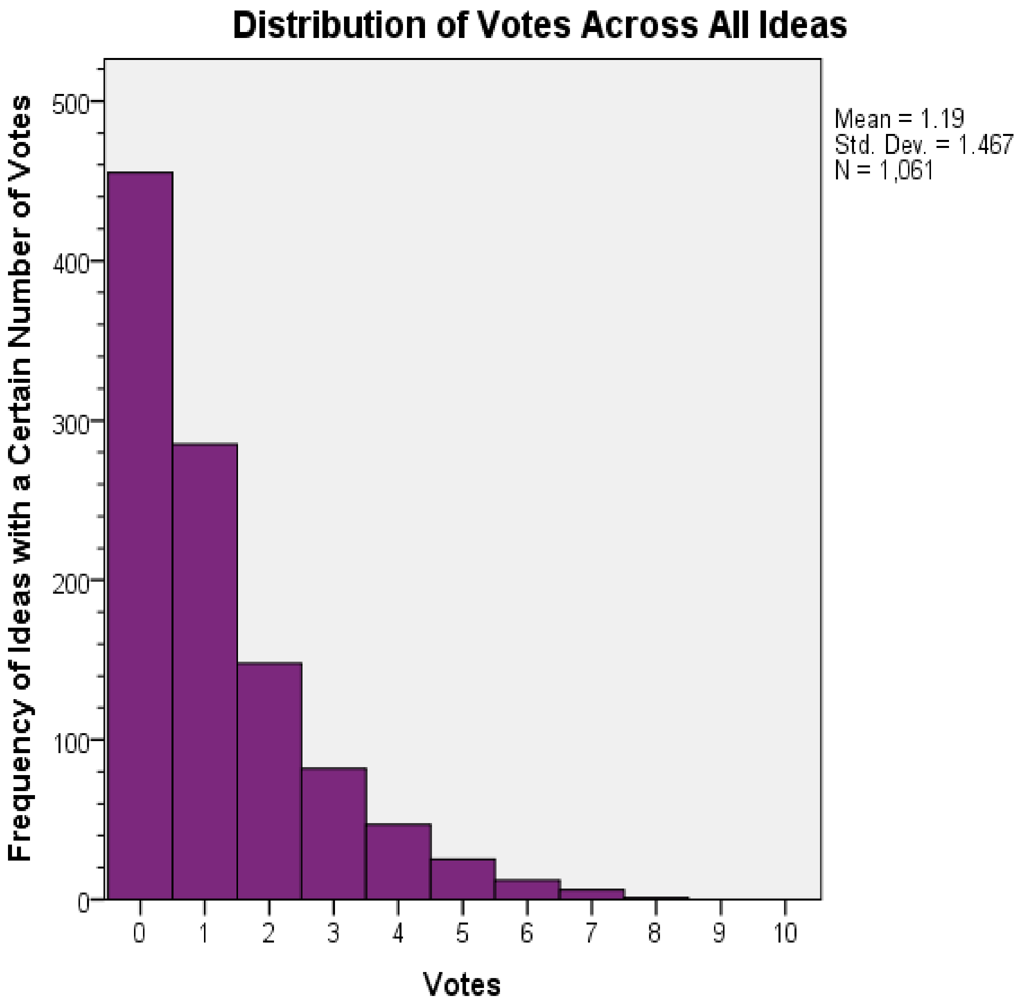


Figure 14. Distribution of Votes Across All Ideas

6.0 Discussion

Before discussing the results of the gender portion and the first-cast-vote portion of the studies, it is important to recognize that in Study 1, Team 9 was found to have produced a statistically significantly higher average number of ideas than the other groups (roughly five more than the next-highest average number of ideas produced by a team). By looking at Team 9's demographics, it does not appear that there were any noticeable differences between either the composition of males and females for Team 9 or the procedure for the experiment. All teams were in the same room for the experiment, so Team 9's higher average of ideas produced is most likely due to chance rather than any specific variable. The project for Study 1 involving individual brainstorming for the prompt of "ways to get kids to eat vegetables" was created with this study in mind. The assignment for Study 2 involving the pre-made ten ideas for the prompt of organization solutions, on the other hand, was created for a different project in the course. This is why the number of ideas were analyzed between groups for Study 1 but not Study 2.

Overall, we have found that in both studies, there is not enough evidence of a difference between males and females to be considered a bias. Males have slightly more tendency to vote on their own ideas, however there is not enough statistical significance to be a bias. This does not necessarily align with literature supporting higher levels of confidence (Dahlbom et al. 2011, Estes and Jinos 1988) and ownership bias (Toh et al. 2016). In Toh et al., results showed that males were more likely to display an ownership bias. This was not the case for our study, as males did not have a statistically significantly higher tendency to vote on their own ideas. This might be due to the fact that in Tohe et al., the split of male and females per group was not even because of the nature of engineering classes typically having more males than females, which may have had an impact on the results (2016). In this study however, teams were assembled to have as close to an equal number of males and females as possible. There are many other possible explanations for these results as well. One possibility is the treatment of males vs. females in the class. If males and females were treated equally in terms of support and critique, both genders may have shown a strong sense of confidence in their own work, which would lead to their similar rate of self-votes. Individual differences could also be an explanation for the results. Based on the results from this study, there is not sufficient information to claim that we as a society are biased or bias-free, however the fact that the results show that there is not a statistically significant difference between genders shows that there might be more equality than originally hypothesized. Some limitations of the gender portion of the studies include that we only looked at one sample of students. Perhaps more compelling evidence might be unearthed if more classes were examined for a gender bias. Another limitation is that we do not know exactly *why* students voted or did not vote for their ideas. Results show how many self-votes each person possessed, but there is no indication as to why. Students may have voted on their own idea because it was genuinely a good idea, or they may have voted on it because they felt an attachment to their own idea. Similarly, students may have *not* voted on their own idea because they wanted to appear modest, whereas internally they would have put all of their stickers on their own idea had it not been for the fear of being judged. There are many different social factors at play that determine how a person will behave, but without asking them directly, it can be difficult to pinpoint exactly what influences voting behavior. As of now, we know that males and females roughly voted on their own ideas the same amount, but we do not have any reasoning for why they did so. Another element to consider is how gender-neutral the prompts were. It is possible that the prompt of “ways to get kids to eat vegetables” could be slightly biased toward females, as it involves knowledge about childcare, a topic that is stereotypically believed to be female-driven. If the prompts were more or less gender neutral, it would be interesting to see how results change. In a prompt that is geared more toward one of the genders, it is possible that participants identifying as that gender could have more confidence in their ideas, and produce more self votes.

The first-cast-vote data, on the other hand, did support ideas presented in studies from the past such as research on the gaze bias (Saito, Nouchi, Kinjo, & Kawashima 2017), risk aversion (Kahneman and Tversky 1979), and groupthink (Janis 1971). It appeared that the first three ideas to receive a vote were almost twice as likely to receive more votes overall. This could be due to many different factors. On the one hand, there might be a gaze bias occurring. As the idea gets the first vote, students focus on that idea, thus their attention may be on it slightly longer than others, resulting in the students awarding that idea a vote. This is consistent with literature detailing the gaze bias (Saito et al. 2017 and Glaholt & Reingold 2009). There is also a possibility of a bandwagon effect occurring. The first idea to receive a vote would be the beginning of the bandwagon effect, and as additional people vote on it, the students who vote later in time might be more inclined to simply follow the crowd. However, this explanation is complicated by the fact that the participants are voting for their perception of good ideas, not just random objects. It is difficult to tell where to draw the line between a group of students who are voting on an idea to follow the crowd, or a group of students who are voting on a genuinely good idea. Similar to this is the fact that if someone sees a vote on an idea, they now know that someone else thinks it is a good idea. Not only is their attention now on the idea, but they are also competing with an internal reasoning that someone else thinks it is a good idea, so it must be worth voting on. Even a person who is attempting to be as objective as possible would have a hard time ignoring the fact that someone else thinks the idea is a good idea, simply because they would immediately start analyzing why the idea was selected, possibly even falsely justifying the decision to vote on the idea by following the crowd.

Another factor to look at is the fact that students are voting on their own time. They are not all placing their dots on the ideas at exactly the same time, down to the second. Instead, they are placing their dot at their own free will, deciding how to vote as they see fit. This leads to a question of how the group dynamics play out in the voting process. Typically, those that are shy are less likely to be the first to step up and place a vote. The first person to place a vote is putting themselves in a vulnerable position by starting the voting session, so that person is most likely going to be someone who is either very confident or a natural leader. The shy students are most likely to not only be the last to place a vote, but also possibly more likely to use that avoidance of risk/vulnerability to their advantage by waiting to see which ideas received the most votes.

It is possible that a bandwagon effect *might* be at play during these studies, as people find that there is less risk in following the crowd and not standing out, consistent with Nadeau et al. (1993), however there is a chance that the ideas are genuinely good ideas, which is what earned the higher number of votes, as well as the fact that it was one of the first ideas to get a vote. This explanation could also apply to the gaze bias: it is possible that the first-voted ideas received those votes because they were indeed the best ideas in the group, so the fact that they received more votes aligns with the goodness of the idea. This is a limitation of the study; further examination of the goodness of the ideas would be necessary to truly distinguish the difference between a possible bias and votes on good ideas.

Finally, it is important to note how the students' knowledge has changed between Study 1 and Study 2. In class, students learned more about idea goodness and how to generate creative ideas, as well as having studio time to develop products. It is possible that in the three weeks between Study 1 and Study 2, students gained more experience and knowledge that allowed them to more accurately differentiate between good and bad ideas. If the students have improved at recognizing creative ideas, it might be possible that ideas that received a vote first were simply being voted on because they were good ideas, and the students were able to recognize that.

Future studies could hold a multivoting session, and then have separate raters evaluate the ideas with the most votes. This could determine the goodness of the idea, and would thus give an indication if the idea has a large number of votes due to it being a good idea, or if it is due to other factors such as a bandwagon effect. In the same future study, it would be beneficial to ask participants for a qualitative explanation of why they voted the way they did. This would give some insight as to whether they voted on a specific idea because it was the best idea, whether it was to follow the crowd, or for a different reason. Finally, in regards to self-voting behavior, having an explanation for why a participant voted on an idea could show how creative they are. If they were the only one to vote on their own idea, it would be interesting to see if they voted because they felt attached to the idea or if they truly viewed it as the best idea. Ideas with no votes are most likely either bad ideas or too confusing for people to understand, so by asking why a participant voted on that idea, it could give a better understanding of if the voting process accurately reflect creative ideas and creative perceptions. An expansion of this idea would be to give participants a creativity assessment and compare their choices in a multivoting session. This could show us how well creative people are able to perceive goodness of ideas.

The main discovery from the current studies is that a multivoting process is best run with these biases in mind. One way to combat the threat of a first-cast-vote bias is to run the voting session digitally. If all participants log onto an interface where they are blind to the votes being cast, that eliminates the chance of participants seeing which idea got a vote first and being biased toward that idea. This could also help researchers determine the goodness of ideas, since by removing any biases regarding the first-voted ideas, participants are more likely to vote on good ideas. By understanding that these biases exist, developers can be more cautious about the results they get from a multivote, and can be prepared to ask more questions to get a better understanding of the ideas before further developing them. Multivoting is important in other stages of the development process, not just initial brainstorming as well

7.0 Conclusions

For the gender portion of this study, we hypothesized that males would be more likely to vote on their own ideas. Results showed that there are slight differences in the average number of self votes between males and females, but these are not statistically significant. Males are not statistically significantly more likely than females to vote for their own ideas, and they do not vote on more of their own ideas than females. More qualitative data would be useful in future studies as it would allow researchers to find out reasoning behind the votes. Asking about their reasoning for their votes could lead to a better understanding of social behaviors, assuming that participants can recognize on some level the true reasoning for their actions. For the first-cast-vote portion of this study, we hypothesized that the first-voted ideas would receive more votes overall. We found that there was a statistically significant difference in average votes (per voted idea) between first-voted ideas and non-first-voted ideas. First-voted ideas had roughly 1.7 times the average number of votes for non-first-voted ideas. Future studies should address the goodness of the ideas that received votes first. Having external judges rate the ideas could give insight as to whether the first-voted ideas received more votes because of a first-cast-vote bias, or because they are genuinely good ideas.

Understanding the creativeness and perception of those that are idea screening is important to providing the most accurate evaluation of ideas.

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