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EXAMINING THE EFFECTS OF DIVERSITY ON AN ONLINE GROUP CREATIVITY TASK

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AN ONLINE GROUP CREATIVITY TASK

by

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ABSTRACT

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AN ONLINE GROUP CREATIVITY TASK

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Prior research has shown that group diversity influences the way one interacts with other group members, as well as how people act differently in a group setting versus being alone. To understand the impact that group diversity has on creativity in brainstorming ideas, this research study was conducted. Using archived data from a previous study, factors such as racial, gender, and educational background diversity were examined to see how they impact the generation of ideas in a group. This study uses college-aged students as participants, but the information derived from this study can inform how groups work, and which factors may drive creative performance. The results showed that idea generation was influenced by fluency and elaboration of ideas was negatively influenced by both gender and school year diversity.

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CHAPTER 1

INTRODUCTION

Teamwork is found in all different kinds of fields whether it be in education, health, communications, or any other field. It is important to understand how people work with one another and what factors influence that. In this article, I examine the impact of group diversity on group creativity.

Creativity is defined as the use of imagination or original ideas, especially in the production of an artistic work. This is seen in several different ways, but in this study, we will be identifying creativity for brainstorming ideas. This concept is used in multiple settings, especially in industries where new items are created to make things in our life easier. Cognitive factors such as internal motivation, concentration, education level, and size of premotor cortex all impact creativity (Park, Kim & Jang, 2016). Depending on how meaningful the task is for which a person is asked to be creative, the amount of effort can differ. For a topic which is relevant and is something a person is interested in, they will have more intrinsic motivation to come up with more ideas which are very creative. A person's education level can impact this because they may already know more information leading to creativity in one aspect whereas those who have not studied as much might have a more open-minded outlook to producing ideas.

A person's ethnicity can impact what they have been exposed to and how they think. Different cultures practice various things, are exposed to varying types of technology

and may not see what other practices and beliefs occur in other parts of the world. This may cause them to think in one direction, so their creativity may be limited in a specific direction. This is important to understand as it has an impact on group creativity. People have preconceived notions about different races. Prior studies, including one by Ramsay and Maginnis (2006), showed that both white and non-white participants believed that race influenced their overall cohort experience. While this study isn't exactly relevant to study in terms of group creativity, it shows another way race can play a factor in group work.

Another factor we examine in this study is diversity, specifically with regard to both surface-level diversity and deep-level diversity. Deep-level diversity is the characteristics which differentiate a person beyond what can be seen upfront. Examples of deep-level diversity include financial status, social status, education level, gender identity, etc. On the other hand, surface-level diversity is how we differentiate people by what we can see in their initial appearance (Mohammed & Angell, 2004). Examples of these include race, ethnicity, gender, etc. Although the study does not differentiate between the two types of diversity explicitly, this is still important to note when applying this research and results in the real world.

One important idea to consider when observing idea generation in groups is how people are influenced in group settings. People may feel less comfortable sharing information and generating ideas in a group, where there is sometimes a fear of judgement, whereas when working alone and not knowing who will be reading their responses, they may be able to come up with more ideas. Studies discussed later in this paper have tried to figure out the best combination of teamwork and individual time to generate the most ideas. In this study, we allow the subjects to generate ideas individually and as a group. When a

person can identify with other members of the group in ideology, they may be more likely to share their response. However, also being in a group setting could narrow one's thought process because they begin to think in the direction of the ideas they are hearing being generated. Therefore, it is important to understand how groups influence this idea generation process, which was measured in this study.

While this particular study focuses on the impact of factors on a group's brainstorming ability with college students, the results of this study can to some extent be generalized to a wider population including those in healthcare, education, and just in general for other groups. By examining and understanding the factors which influence group creativity, we can better understand how groups work in both a school and work setting.

CHAPTER 2

LITERATURE REVIEW

2.1 Different Types of Diversity in Group Idea Generation

While our current study focuses on group brainstorming, other research has been done similar to this with other types of hypotheses. A study was conducted which developed on prior research to understand the impact of cultural diversity on group process and problem solving (Watson, Kumar, & Michaelsen, 1993). Three different key ideas were addressed in the study in order to find out information which was not already found in prior research. The results of this experiment showed that homogenous groups performed significantly higher than diverse groups for the problem identification tasks as well as their quality of solutions and overall performance (Watson et al., 1993). Other studies have also supported this idea and showed that diversity in groups regarding any aspect can lead to higher conflicts and lower levels of cohesiveness (Milliken, Bartel, & Kurtzberg, 2003).

Race is a key factor which distinguishes people and is a factor used to also judge people by. In the article by Ramsay and Maginnis (2006), the researchers conducted a study to see how race impacts groups and in order to do this, a set of surveys was administered. The participants included both students of color as well as white students who were either first-year students or second year students in their undergraduate cohorts. When asked how race influenced their overall cohort experiences, students indicated that race was an influential factor. While the white students believed that race did influence their progress

and experience with the group, more knowledge about the race changed their experience later with the same people. For another question, students answered that race did influence relationship-building within the groups including building friendships. Overall, the results showed that both the white participants and colored participants felt that race was a factor which influenced team building and group connections. However, this study did not involve idea generation or creativity directly, unlike the present study.

2.2 Group Creativity

When discussing group creativity, it is often the collaboration of two or more individuals. Creativity has often been defined in terms of several features such as fluency, flexibility, and originality in thought (Guilford, 1950; Torrance 1969). Creative processes have also been associated with the idea that both divergent and convergent thinking processes are necessary and allow for the development of creative outcomes by work groups (Milliken, Bartel, & Kurtzberg, 2003).

At one point, it was thought that group creativity should be avoided as it hinders progress (Paulus & Brown, 2003). This article traces back the origins of brainstorming and how it can be effectively done in a group setting. One of the ways in which brainstorming was thought to be hindered was through the evaluation of ideas before deeply exploring their possibilities. Osborn (1957), who developed this formalized idea of brainstorming, argued that to have effective brainstorming one should focus on the quantity of the ideas to ensure a lot of ideas can be produced.

When comparing group brainstorming to individual brainstorming, research has shown that solitary brainstorming generates more ideas than group brainstorming. A key outcome of evaluation of peers is production loss. By seeking for the reassurance of

agreement of peers, people are less likely to be comfortable sharing their idea in a group setting. Researchers (e.g., Korde & Paulus, 2017) argue that it is better to have individuals brainstorm on their own, but if it is done in a group setting, methods of minimizing this evaluation apprehension should be implemented. However, a factor which does help with generating ideas is that when people in a group are generating ideas, it allows people to be both stimulated and motivated, and thus increases their ability to produce ideas (Korde & Paulus, 2017).

Understanding how different factors affect group creativity and idea generation regardless of age groups can help generalize the information to the majority of people. Park, Kim and Jang (2017) discuss the factors which foster creativity amongst elementary students. Some cognitive factors found from prior research include intrinsic motivation, confidence, and metacognitive skills. Higher intrinsic motivation and confidence have been associated with greater creativity. The factors examined in this particular study were gender, scientific attitude, and attentiveness in science class as they relate to creative personality. The results showed that girls had a higher attentiveness than boys by 0.15 points whereas the scientific attitude was higher in boys by 0.18 points than girls. Although the factor of gender was not significant, a strong correlation was seen between scientific attitude and creative personality which might also be generalized to other subjects and topics.

In another article, Korde and Paulus (2017) researched the differences between individual and group idea generation but also focused on the use of both in one situation. The best performance was seen with the hybrid group in which they did both individual brainstorming as well as group brainstorming. Some of the theories which did not align

with the findings in this study included the social comparison theory, as the participants did not improve when moving from individual to group setting. As prior research has found, generating ideas in a group did not produce more ideas than when working alone. In the case of the hybrid group, a significant number of ideas were produced once people were able to work alone after being in a group.

2.3 Diversity

Prior research has shown that both types of diversity (surface-level and deep-level) influence group outcomes. Many theories were created to explain the negative outcomes of team diversity, including social identity theory. This theory supports the idea that people are less likely to open up or share their ideas when they feel they are amongst a group of people dissimilar to them but would be more biased towards and feel more motivated to express their ideas around those who are more similar to them (Mohammed & Angell, 2004). The article also discusses how those who are in groups with people different to them will hold more feelings of animosity and or hostility towards those team members.

Similar research has been found by other authors in which they found that congruence in general encourages an individual to strongly believe in their preconceived notions about a person when their ideas are supported (Philips & Loyd, 2003). Studies which tested to see the impact of surface-level and deep-level diversity on how groups reacted found that those working in groups that were not homogenous for surface-level characteristics spent more time discussing the task at hand as opposed to the homogeneous surface-level groups (Philips & Loyd, 2003). Other studies have shown that over time, as work members work together, the effects of surface-level diversity are weakened and the

effects of deep-level diversity within group members is strengthened (Harrison, Price, & Bell, 1998).

2.4 Summary, Gaps in the Literature, and Study Aims

Previous research into the effects of diversity on group creativity has been mixed. On one hand, diversity is thought to increase the probability of intergroup conflict, and therefore result in productivity loss. However, this same conflict may relate to better quality ideas through extended discussion. More research is needed to understand how different diversity factors, such as age and gender, are related to performance on group creativity tasks, especially as the literature has remained focused on race and ethnicity (Paulus et al., 2019). Additionally, different contexts may change the relationship between diversity and creativity outcomes. For example, does the diversity of groups differ between online and in-person interaction? Asynchronous, online collaboration between team members is becoming more prevalent, and researchers have begun to investigate how electronic interfaces may change aspects of group creativity (Ocker, 2005; Staples & Zhao, 2006). Previous creativity research has examined how both group dynamics and group brainstorming processes may be different for virtual teams versus physical teams (Staples & Zhao, 2006; Paulus et al., 2006). However, diversity of virtual teams has mostly been discussed under the lens of cultural diversity and international teams.

To explore some of these aspects of group creativity, archival data was collected and analyzed. The present study is an analysis of archival data from 2016. The study aims to examine the effect of group diversity relative to two surface-level social categories (race and gender) as well as two deep-level academic categories (student year classification and college of major). The archival dataset contains information on a group creativity task

where participants design a "university of the future". Participants worked together asynchronously through an online forum across three sessions. After the conclusion of these sessions, participants individually submitted a final overview document organizing their ideas. The original study was conducted to test hypotheses related to homogenous and heterogeneous college groups, e.g. participants were randomly assigned to groups of students in either the same university college or different university colleges (e.g., College of Science, College of Liberal Arts). However, additional hypotheses relevant to the creativity of diverse groups can be tested by using measures of group diversity as predictors of various creative performance outcomes. While these were not a part of the original experimental controls, measures of group diversity can be calculated and modeled statistically. Based on the previous research in the area, it is expected that diversity will have a beneficial effect on both idea generation and quality of ideas (Paulus et al., 2019). Therefore, the following hypotheses were examined:

Hypothesis 1: Members of collegiately heterogenous groups will generate more ideas on average across asynchronous group sessions and elaborate more often on average on others' ideas across sessions, than members of collegiately homogenous groups.

Hypothesis 2: In their individual overview document, members of collegiately heterogenous groups will generate more ideas, generate more highly novel ideas, and generate more novel ideas on average than members of collegiately heterogenous groups.

Hypothesis 3: All four diversity indices will significantly predict performance across group sessions, such that the more diverse an individual's group, the more they will generate ideas or elaborate on others' ideas.

Hypothesis 4: All four diversity indices will significantly predict performance in the individual overview, such that the more diverse an individual's group is, the more ideas they will generate, and the more novel their ideas will be. The latter should be reflected in both average novelty score of items, as well as the number of highly novel items.

CHAPTER 3

METHODS

3.1 Participants

The present study uses archival data from 2016. Students from the University of Texas at Arlington were recruited for study participation using university approved flyers and emails. The sample included both undergraduate and graduate students. Potential participants were offered $40 worth of gift cards in exchange for participation, with gift cards of lesser worth awarded if participants did not complete all study sessions. A significant amount of attrition occurred throughout the sample; therefore, a final sample of $N = 120$ participants grouped into 30 groups of four were used for analyses. Missing data procedures are detailed in the Results section.

3.2 Materials

Participants used Simple Machines Forum (Simple Machines, 2020) to communicate with one another, as well as to submit ideas generated during each session. All group members remained anonymous throughout the study; each participant was given a screen name reflective of college and major (e.g. “Science: Psychology”, “Liberal Arts: History”). Participants only interacted electronically, and not in person. Before each discussion session, participants were given Osborn’s brainstorming rules (1957), which are designed to eliminate sources of production blocking among group members (see Appendix A).

3.3 Measures

In order to measure the diversity within each group, demographic information was used to calculate Blau's variety index (1977) at the group level for the following social categories: gender, race, college (e.g., College of Nursing, College of Business) and year (i.e., classification: undergraduate senior, master's level, or doctoral level). Blau's index is used as a measure of category variety, where differences in category membership are presumed to have different and unique information. It is calculated as $1 - \Sigma p_k^2$, where p is the proportion of members in k number of possible categories (Harrison & Klein, 2007). The index ranges from a minimum of 0 (indicating complete homogeneity) to a maximum of $k - 1 / k$.

To examine individual differences in the generation of ideas, as well as to statistically control for such differences, verbal (semantic) fluency was measured using a word association task. The task required participants to generate related responses to a set of 10 words: business, engineering, tuition, future, university, institution, library, online, school, science. A time limit of 60 seconds was imposed for each stimulus, with one word presented at a time. Fluency was measured as the average number of words generated across these ten categories.

To measure creative performance, ideas and elaborations generated in the discussion board were counted by research assistants. Due to attrition of study participants, ideas and elaborations were averaged across the number of sessions each participant completed. In addition to these performance measures, ideas comprising the overview were counted and individually rated by research assistants for novelty (1 = not very novel, 5 = very novel). Three measures are associated with this procedure: the number of ideas

generated in the overview, the average novelty of ideas, and the number of highly novel ideas (i.e., ideas rated as a 4 or 5).

3.4 Procedures

Once each participant contacted the researchers, they were informed via email (see Appendix B) that the study would take place over multiple sessions, with the first session taking place in a research lab and the other two subsequent sessions taking place online. Upon scheduling and attending the first session, participants consented to the study, and were randomly assigned to be in either a heterogeneous or homogenous group. Each group consisted of four students; assignment was based on the college each student belonged to. Participants first completed the set of word association tasks. Following this, participants completed a demographic survey, and then were added to an online discussion board. Using this discussion board, participants individually generated ideas related to "an ideal university of the future" for 20 minutes. After the conclusion of session one, participants were thanked for their time, and told that further instruction would come via email.

In session two, participants' ideas were merged into a single discussion board consisting of all their own ideas, as well as the ideas of each of their group members. Participants were notified via email to start work on session two. First, participants were instructed to read all ideas on their group's board and vote on good ideas. Then, participants were asked to post original ideas, as well as build/elaborate on each other's ideas (see Appendix C for session two instructions). Session two occurred over the course of one week; participants could contribute to the discussion board as often as they liked. Reminder emails were sent before the conclusion of session two. In session three, participants were instructed to vote on good ideas from all ideas generated during session two, and again

generate new ideas afterwards (see Appendix D for session three instructions). Session three lasted for one week. After the conclusion of session three, participants were instructed to complete an additional overview document describing an ideal university of the future. Participants were instructed to use content from the discussion board. After submitting this document via email to the researchers, participants were directed to a final survey. Once all study procedures were complete, participants were thanked and given gift cards. The value of the gift card was relative to how many group sessions were completed, with $40 in value awarded for full participation.

CHAPTER 4

RESULTS

4.1 Comparison of Those in Collegiately Homogenous and Heterogeneous Groups

First, since participants were randomly assigned to either heterogeneous or homogenous groups, the creative performance of individuals based on group type were compared. Hypothesis 1 was examined using *t*-tests. Welch's *t*-tests were used for their robustness when comparing groups with unequal variances (Delacre et al., 2017). Because not all participants finished all three sessions, ideas and elaborations were averaged across sessions to make creative performance more comparable. There was no significant difference between those in collegiately homogenous and heterogeneous groups in the average number of ideas generated per session, $t(108.7) = 0.03$, $p = .98$, 95% CI [-1.45, 1.49], $d = .01$. There was also no significant difference between groups in the average number of elaborations generated per session, $t(118) = 0.92$, $p = .36$, 95% CI [-0.41, 1.13], $d = .17$. Therefore, Hypothesis 1 was not supported.

Per Hypothesis 2, individual overview performance was also compared between type of group. These analyses were performed using only participants who had completed the overview ($n = 85$). There was no significant difference between groups on average novelty of overview ideas, $t(69.49) = -0.98$, $p = .33$, 95% CI [-0.53, 0.18], $d = .22$. There was also no significant difference between groups on the number of highly novel overview ideas, $t(79.03) = -0.02$, $p = .98$, 95% CI [-1.68, 1.64], $d = .004$. However, the results for the number of overview ideas generated approached significance, $t(81.30) = 1.76$, $p = .08$, 95%

CI [-0.29, 4.74], $d = .37$. Those in collegiately homogenous groups ($M = 10.94$, $SD = 6.45$) generated marginally more ideas than those in collegiately heterogeneous groups ($M = 8.71$, $SD = 5.19$). This marginal finding was in the opposite direction than originally hypothesized. Therefore, no support was found for Hypothesis 2.

4.2 Predicting Individual Creative Performance from Group Diversity Indices

To further explore the effects of diversity, a set of linear mixed models was performed to assess the relationship between different types of diversity (racial, gender, collegiate, and year classification), as well as verbal fluency, on creative performance. Linear mixed models, also known as hierarchical linear models, were chosen for their ability to model both individual and group-level predictors and account for the nested structure of the data (Bates et al., 2015). The model accounts for the fact that members of a given group will have the same diversity index values as their other group members, while also allowing individual data on creative performance and verbal fluency to be included in the model. Analyses were performed using the R programming language, using the library "lmerTest" (Kuznetsova et al., 2017). All models were fitted using restricted maximum likelihood, and Satterthwaite's method was used to compute tests of significance for each predictor.

Hypotheses 3 and 4 were both examined using linear mixed models. Tables 2 and 3 show significance tests of fixed effect regression coefficients for each predictor. As seen in Table 2, only scores on the verbal fluency task were significantly predictive of average number of ideas generated per session. However, as seen in Table 3, both gender diversity of groups and year diversity of groups, in addition to verbal fluency, significantly predicted the average number of elaborations per session. The negative *b* values for each diversity

index indicate that as groups become more homogenous with respect to gender and year, individuals within those groups tend to elaborate more on other group members' ideas. These findings were in the opposite direction than originally hypothesized. Thus, Hypothesis 3 was not supported.

To test Hypothesis 4, diversity indices and verbal fluency were used to predict performance on the overview task. Again, these analyses were performed using only participants who had completed the overview ($n = 85$). The set of predictors were not found to significantly predict total overview ideas, average overview idea novelty, or number of highly novel overview ideas (all ps > .05). Therefore, Hypothesis 4 was not supported.

CHAPTER 5

DISCUSSION

5.1 Interpretation of Findings

The first test was conducted to examine support for Hypothesis 1. The results showed that there was not a significant difference in idea generation or elaboration between heterogeneous groups or homogenous groups. Individual overview performance was compared between groups as well, per Hypothesis 2. The hypothesis was not supported, in that homogenous groups produced more overview ideas than the heterogeneous groups, and a marginally significant finding in the opposite direction was observed. This was an interesting finding, as a creative performance benefit for heterogeneous groups was expected from having more academic perspectives to draw from (Paulus et al., 2019). However, college variety using Blau's index was not a significant predictor of creative performance. It may be the case that the "university of the future" task would not vary between colleges, therefore making college less relevant of a diversity category for this specific task (Paulus et al., 2019).

Despite no support being found for the study hypotheses, an interesting finding emerged: year classification and gender diversity significantly (and negatively) predicted the average number of elaborations generated in the group sessions. The significant prediction of average elaborations by academic classification supports the idea found in a study conducted by Curşeu, Raab, Han, & Loenen (2012). Via social network analysis, the authors revealed an overall performance benefit for homogenous groups depending on the

task (Curşeu et al., 2012). Curşeu and colleagues (2012) attribute this to the tendency of individuals within the same educational level to display similar information search behaviors; these behaviors may have been reflected in the present dataset by increased elaboration of others' ideas. The effect of gender diversity is perhaps the most puzzling finding. Despite little to no evidence that gender diversity increases creative performance, it was found to be a significant negative predictor of elaboration of ideas in the group sessions. This may be due to gender differences in language usage and communication. In a meta-analysis of gender differences in language use, women were more likely to use affiliative language versus men (Leaper & Ayres, 2007). The present sample skewed female, making female homogenous groups more common than male homogenous groups.

5.2 Limitations and Future Directions

As previously stated, a few limitations of the study's design attenuate the conclusions that can be drawn from its findings. The most significant limitation is the attrition rate. Per-analysis deletion was used for each set of analyses, which meant that fewer data points were used than originally collected. Missing data imputation was not considered based on the extent and type of data missing, as well as the scope of the project. While deletion methods are not ideal for social science research, the reporting of missing data is important for discussing results, while being conservative about their implications (Berchtold, 2018). For example, it is possible that participants experiencing too much intergroup conflict dropped out of the study, which would be relevant to the hypotheses being tested. It is simply not known what the cause of study attrition was. One potential reason is participant fatigue, where lack of motivation to continue generating ideas over several weeks led to dropout. Later examinations of the dataset may include assessment of

the pattern of the missing data, as well as analyses that make use of more advanced imputation methods (Berchtold, 2018).

Other limitations are inherent to the use of a correlational and archival research design. The use of archival data meant that the majority of the independent variables (e.g., the variety indices and verbal fluency) were studied as correlational factors and not experimentally manipulated, though random assignment was done for collegiate heterogeneity/homogeneity. Thus, little in the way of causality can be claimed. Future studies could also use random assignment of group members by race, gender, and year, as well as college. This will avoid situations where diversity is also confounded with sample representation. For types of diversity with a small number of possible categories, this will allow cleaner separation of variety as an explanatory factor versus the proportion of a particular group. Additionally, since various aspects of interaction between group members were not examined directly (e.g., linguistic analysis of messages, or self-reported attitude scales regarding group interactions), future studies of the effect of diversity on group creativity may include moderating or mediating variables related to group processes.

5.3 Summary

The purpose of this experiment was to identify which group diversity factors were related to performance in asynchronous online group brainstorming sessions, with an individual creativity task both preceding and following group sessions. Of the original hypotheses, none found support, though interesting and novel findings in the opposite direction hypothesized were found for academic classification diversity and gender diversity. Further research is needed to identify the driving factors of both positive and

negative effects of diversity, and to identify the effects of each type of diversity on both in-person and virtual teams.

APPENDIX A

INTRODUCTION TO STUDY

Thank you for your interest in participating in our research study. This discussion group will take place over three sessions lasting a total of approximately 3 hours. Participants will come into the lab for session one (approximately 30-45 minutes), complete session two (approximately 30 minutes) and three (approximately 2 hours over the course of 3-4 days) from home or another location with internet access. Compensation for this research will be $40 in gift cards, spread out over the course of participation. If you are still interested in taking part in the discussion group, please respond to this email and include your year/level in school and major (as well as specialty if applicable).

Thank you,

UTA Networks Lab

APPENDIX B

SESSION TWO INSTRUCTIONS

Session Two instructions:

Now that you have completed session one, you will need to log on to the discussion board to complete session two. After entering your password, click on the available link titled: "All Participants: Session 2". Then click on the next topic that appears titled "Session 2: Ideal University". Spend approximately 10 minutes reading over all of the ideas in this topic. Take note of the number of pages (located in the top left and bottom left corner before and after all of the posts); this is important because you will have to manually select the next page if there are multiple pages of posts. After spending time reading through the ideas, we would like for you to select the ideas which you think are the good ideas. You will do this by selecting the "quote" button located to the right (and slightly above) the post that you are selecting. By selecting this button you will be directed to the "quick reply box". You will notice that the post you selected has been auto-filled into the "quick reply box". Please leave this text there, and on the last line of the "quick reply box" you will type #goodidea. You will repeat this process for every idea that you think is a good idea. After you have spent approximately 10 minutes doing this, spend about twenty minutes elaborating on other ideas and generating new ideas. You may do this at the same time as voting or on a different day. Remember, each new idea should be a separate post. To elaborate on an existing idea, you will again use the "quote" feature. After twenty minutes, please log out and wait for instructions for session 3. We will begin session 3 once all participants in the group have complete session 2. You are able to continue generating new ideas until session 3 begins. Discussion board website: utanetworks.net/smf/.

APPENDIX C

SESSION THREE INSTRUCTIONS

Session Three Instructions: Now that you have completed sessions one and two, we will finish the discussion group with session three. We would like for you to firstly log in to the discussion board and read all of the new ideas and elaborations from session 2. You will then select the ideas/elaborations that you think are good ideas. As you have already done this for the session one material, please only focus on the new ideas and elaborations from session 2 (these will begin several posts in and will be noticeable because the first idea from session 2 will have a quote with #goodidea. Begin there and read the remainder of the posts). Again, take note of the number of pages (located in the top left and bottom left corner before and after all of the posts); this is important because you will have to manually select the next page if there are multiple pages of posts. Remember, to quote a post you will select the "quote" button located to the right (and slightly above) the post that you are indicating is a good idea. By selecting this button you will be directed to the "quick reply box". You will notice that the post you selected has been auto-filled into the "quick reply box". You will leave this text there, and on the last line of the "quick reply box" you will type #goodidea. You will repeat this process for every idea that you think is best or most creative. After quoting the ideas that you think are good ideas, we would like for you to spend time over the next 4 days generating new ideas and elaborating on other ideas. Please log in to the discussion board several times a day and spend about 15 minutes or so each time you log in reading the new ideas and making elaborations or generating new ideas. Post as many ideas as you can during this time frame. After the session ends, you will receive a document and survey to complete which will conclude your participation in this research. Follow this link to the discussion board: utanetworks.net/smf/

APPENDIX D

GOAL OF EXPERIMENT

"The goal of this experiment is to create a plan for the ideal university of the future. Your job is to generate as many ideas as possible towards the development of this topic. You will work first individually and then with members of your group (remind them of this group type: same or different major) to complete this task. In session 1, you and your group members will work independently. You will submit your ideas using a computer by typing them onto an online message board. The creative task will continue in session 2 as a group project: you will be allowed to view your group members' ideas (and they yours). All your communication with your group members will only be about ideas for your topic. Do not worry about perfect spelling or grammar. When listing ideas to the brainstorming topic, there are some things we want you to keep in mind:

1. *Criticism is ruled out*. Adverse judgment of ideas (own or others') must be withheld. Say everything you think of. Do not worry about what someone else will think about your idea and do not criticize anyone's idea.
2. *Freewheeling is welcome*. The wilder the idea the better. It is easier to tame down than to think up. Do not be afraid to say anything that comes to mind. The further out the idea the better. This will stimulate more and better ideas.
3. *Quantity is wanted*. The greater the number of ideas the more likelihood of good ideas. Come up with as many as you can.
4. *Stay focused on the task*. Concentrate on the problem at hand and avoid engaging in irrelevant thought processes and discussions.
5. *Build on ideas*. Feel free to build on your own ideas or ideas generated by other group members. It is okay to combine two or more ideas to create a new one. Any questions?"

“You will now be generating ideas on your topic. Your topic is “Create a plan for the ideal university of the future.” Generate as many ideas as you can towards the development of this topic. When considering the ideal university of the future, consider the following: how will it be organized and structured, how will learning and research be conducted, how will it be funded. Keep in mind the components that make up this idea including the academic, economic, administrative, physical, social, cultural, and organizational changes. Use only recognized English words in your posts. Do not use made-up words. Please do not restrict yourself to any one aspect. Again, remember to submit each new, individual idea as a separate post. Any questions?"

APPENDIX E

TABLES

Table A.1: Demographics of Study Sample (N = 120)

Age	*M*	*SD*
	24.59	6.06

Race	*n*	%
African-American	13	10.83%
Asian	52	43.33%
Caucasian	25	20.83%
Hispanic or Latino	20	16.67%
Native Hawaiian/Pacific Islander	1	0.83%
Other	9	7.50%

Gender	*n*	%
Female	77	64.17%
Male	43	35.83%

Year	*n*	%
Undergraduate Senior	63	52.50%
Master's Level	52	43.33%
Doctoral Level	5	4.17%

College	*n*	%
Architecture	4	3.33%
Business	20	16.67%
Education	10	8.33%
Engineering	33	27.50%
Liberal Arts	20	16.67%
Nursing	16	13.33%
Science	15	12.50%
Social Work	1	0.83%
Undeclared	1	0.83%

Table A.2: Fixed-Effect Regression Coefficients for Average Ideas per Session

Predictor	*b*	*SE*	*df*	*t*	*p*	95% CI LL	95% CI UL
Verbal Fluency	0.26	.09	113.98	2.82	.01**	0.07	0.43
Gender Variety	1.73	3.29	24.76	0.53	.60	-4.32	7.77
Race Variety	1.17	2.45	26.72	0.48	.64	-3.33	5.69
Year Variety	-1.22	2.84	25.06	-0.43	.67	-6.43	4.00
College Variety	-0.30	1.56	24.98	-0.19	.85	-3.16	2.57

Note. *$p < .05$, **$p < .01$.

Satterthwaite's method used to determine *p*-values.

Random effect of group not significant at $p < .05$.

Table A.3: Fixed-Effect Regression Coefficients for Average Elaborations per Session

Predictor	*b*	*SE*	*df*	*t*	*p*	95% CI LL	95% CI UL
Verbal Fluency	0.11	0.05	106.88	2.47	.02*	0.03	0.20
Gender Variety	-3.21	1.36	24.60	-2.37	.03*	-5.79	-0.63
Race Variety	0.36	1.02	27.12	0.35	.73	-1.59	2.31
Year Variety	-2.84	1.17	24.98	-2.42	.02*	-5.07	-0.61
College Variety	0.61	0.64	24.88	0.95	.35	-0.61	1.84

Note. *$p < .05$, **$p < .01$.

Satterthwaite's method used to determine *p*-values.

Random effect of group not significant at $p < .05$.

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BIOGRAPHICAL INFORMATION

Deepti Yogananda has been a student at the University of Texas at Arlington since 2017. Her goals include pursuing her master's in healthcare management policy after graduation and becoming a healthcare administrator at a hospital. Although this was one of her first research projects, she hopes to use the information gathered through this research in her career in the future. Her education and experiences have helped shaped and led her to develop an interest in working in the hospital and pursuing a career as a healthcare administrator. Through completing this project, she was able to develop research skills which can be very helpful for her in her master's program as well as her career.