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An Approach to Improving Creativity and Satisfaction in Group Convergence using a Group Support System

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ABSTRACT

This study examines convergence under differing divergent starting conditions in order to identify techniques which could lead to more creative outcomes and more satisfied session participants. Specifically our research asked whether or not groups in a convergence activity are more creative and satisfied based on whether they start with pre-defined ideas (i.e., examples to start with) or brainstorm on their own first. The results of the lab experiment suggest that groups who rely on pre-defined ideas when working on a convergence activity are both more creative and more satisfied than groups who brainstorm to start.

KEYWORDS

Convergence, thinkLets, collaboration engineering, group support systems, collaboration, facilitation.

INTRODUCTION

Group work is important for the simple reason that individuals can accomplish more as a group than they can alone. For instance, research has shown that through collaborative efforts groups are able to develop more innovative ideas because they have a larger knowledge base to pull from (Adkins et al. 2003). Many group meetings follow a common pattern in sequencing their collaboration activities (Chen et al. 1994). In most cases, after the specific problem the group needs to solve is identified, the group will first diverge to develop a list of possible solutions to the problem, and then they will converge to a smaller set of those ideas which they will then continue to work with (Chen et al. 1994). This divergence process has been defined as moving from having fewer to having more concepts, an activity that is also often referred to as “brainstorming.” Convergence then describes the process that occurs when a group considers and reduces a set of information they are working with to a lesser number of concepts considered worthy of further attention (de Vreede et al. 2005).

Many group support systems (GSS) include functionalities for the divergence and convergence patterns of collaboration. Divergence, or brainstorming, functions by allowing participants to contribute ideas individually while also reading and elaborating on the ideas of others to improve the overall results. A significant amount of research has studied electronic brainstorming (EBS) to determine such things as optimum group sizes for ideation, techniques to increase creativity, and a variety of other aspects (Dennis et al. 1999a; Gallupe et al. 1992; Valacich et al. 1995). However, researchers have noted, much less research has been conducted on other patterns of collaboration, specifically convergence (Briggs et al. 1997; Davis et al. 2007; Hengst et al. 2007). Consequently, while many GSSs also provide convergence capabilities, there is less understanding of exactly how specific features contribute to improving group convergence. In order to address this dissatisfaction with group convergence, collaboration engineers have established various thinkLets that can be used in order to help a group reach convergence. A thinkLet is a repeatable facilitation technique that comprises all the information required to create one repeatable, predictable pattern of collaboration (e.g., in this case convergence) among people working toward a goal (Briggs et al. 2003a).

Our research will attempt to improve our understanding of the convergence process by examining a new convergence thinkLet, FocusBuilder (Davis et al. 2007), in a laboratory experiment to assess its performance, specifically in relation to creativity and satisfaction. Our research question asks: *does the accountability (i.e., whether or not the participants generated the brainstorming of ideas) of the divergence task that precedes a convergence task affect the resultant creativity or satisfaction in a facilitated GSS session?*

The next section introduces the processes of divergence and convergence along with the theoretical background of creativity and satisfaction that underpin both of those patterns of collaboration. The subsequent sections present our research design and findings, while the paper closes with a discussion of those findings and their implications followed by the conclusion, limitations, and areas for future research.

BACKGROUND

Divergence

In practice, divergence is one of the first steps in a group problem-solving activity where a group has the opportunity to identify as many possible solutions as possible to some challenge it faces. This step usually involves some form of ideation which is more commonly referred to as “brainstorming.” Brainstorming was originally conceived by Osborn (1957) and has since served as the foundation of countless ideation sessions. The core of Osborn’s (1957) approach was the proposal that when a group worked together to generate ideas, each individual’s contributions would trigger another idea within one’s own mind and could also spark ideas in their colleagues’ minds. Osborn (1957) described this synergistic effect and noted a significant boost in both the number and quality of ideas a group could generate. While studies have since empirically contradicted Osborn’s assertions (e.g., Diehl et al. 1987; Taylor et al. 1958) the emergence of the brainstorming capabilities embedded in most GSSs proved EBS to be more productive than traditional brainstorming (Gallupe et al. 1992). More recent studies continued to examine different forms of EBS wherein the forms of the brainstorming prompts are varied to produce different levels of creativity within those productivity results (Santanen et al. 2000).

Convergence

Convergence is defined as “to move from having many concepts to a focus on and understanding of a few deemed worthy of further attention” (de Vreede et al. 2005). Convergence most often follows divergence as the ideas generated from the divergence step are then distilled into categories or concepts for subsequent group activities. The overall goal of convergence is to reduce the cognitive load of a group to better focus attention of key concepts, and in many cases, convergence also has the additional purpose of establishing shared meaning of each of the concepts for the group members (Davis et al. 2007). Despite these benefits, research has discovered that the activity of convergence is a challenging and time consuming process for groups (Chen et al. 1994).

Research has suggested that limited guidance exists on how to best structure convergence activities in groups (Briggs et al. 1997), but GSS researchers have proposed various methods for convergence. Some researchers have suggested that a combination of electronic and verbal communication modes during convergence can benefit participants due to the fact that key concepts can be identified and represented with a minimum of cognitive load on the group members (de Vreede et al. 1997). Other researchers have suggested that face-to-face, or verbal communication, is best suited for group members to converge and establish shared meaning because it provides the fastest feedback (Dennis et al. 1999b). Existing convergence thinkLets rely on various combinations of both electronic and verbal communication methods (Davis et al. 2007). This research specifically focuses on the FocusBuilder thinkLet. Davis, de Vreede, and Briggs (2007) describe the thinkLet of FocusBuilder as follows:

“All brainstorm ideas are divided into as many subsets as there are participants. Each participant receives a subset of brainstorm ideas and is tasked to extract the critical ideas. Extracted ideas have to be formulated in a clear and concise manner. Participants are then paired and asked to share and combine their extracted ideas into a new list of concise, non-redundant ideas. If necessary, the formulation of ideas is improved (i.e., the pairs focus on meaning, not merit). Next, pairs of participants work together to combine their two lists into a new list of concise, non-redundant ideas. Again, the formulation of ideas is improved if necessary. The pairing of lists continues until there are two subgroups that present their results to each other. If necessary, formulations are further improved. Finally, the two lists are combined into a single list of non-redundant ideas.”

Creativity

Creativity is important for problem solving and innovation (Sonnenburg 2004). Interestingly, research has noted that most creative acts take place in a collaborative context (Sonnenburg 2004). Depending on the group task, this creativity can either be divergent or convergent. In terms of divergence, the core of brainstorming is the notion that looking at ideas from others can make one more creative. The Cognitive Network Model has been used in research to develop a brainstorming technique called “directed brainstorming” (Santanen et al. 2000). Related to our research, the idea of starting with someone else’s idea is equal to directed brainstorming and therefore is expected to increase creativity (Santanen et al. 2000). We propose people may be more creative when looking at examples to start with. As mentioned earlier, the collaborative efforts of a group enable group members to develop more innovative ideas because they have a larger knowledge base to pull from (Adkins et al. 2003).

While an example of divergent creativity is the task of brainstorming and an example of convergent creativity is narrowing those brainstorming ideas to a final set of solutions. What we want to look at with our research is how one specific technique may cause the activity of convergence to be creative; groups beginning with pre-defined ideas (i.e., examples to start with), or allowing them to brainstorm on their own first.

The concept of creativity has been operationalized by Santanen, Briggs and de Vreede (2000) who measured creativity in their study based on the number of unique solutions and the number of effective solutions. We base our operationalization of creativity on the same factors.

Satisfaction

Satisfaction in meetings relates to positive feelings about meetings among group members. More formally it has been defined as “an affective arousal with a positive valence on the part of a participant toward a meeting” (Briggs et al. 2003b). Previous research has argued that satisfaction is one of the most important constructs in GSS research because it has been shown that individuals who do not find their GSS experience satisfying may not use GSS for subsequent tasks (Reinig et al. 1995/1996). Additionally, some studies have shown that the more productive groups are the more satisfied they are (Gallupe et al. 1992). What we are curious about in this research is whether or not creativity has a similar relationship with satisfaction.

Due to the importance of satisfaction, the construct has been operationalized in many studies. A meta-analysis of approximately 200 GSS experiments found that over 25 percent of GSS research hypotheses addressed meeting satisfaction (Fjermestad et al. 1998/1999). In our research we follow the operationalization from Gallupe et al (1992) in which we ask: 1) were you satisfied with the process used today? and 2) would you advocate this process for others to use to generate ideas?

RESEARCH DESIGN

Research Questions

As mentioned above, the purpose of this study is to run a laboratory experiment in order to assess the performance of FocusBuilder, in particular in relation to creativity and satisfaction. Specifically our primary research question asks: *does the accountability (i.e., whether or not the participants generated the brainstorming of ideas) of the divergence task that precedes a convergence task affect the resultant creativity or satisfaction in a facilitated GSS session?* Based on the background and previous research it may be that groups are more creative when they have ideas to look at other than their own, as those ideas might trigger other thoughts. Additionally, it may be that groups will be more satisfied when they begin a convergence activity with ideas to look at other than their own. Therefore, the specific research questions to be examined in this research are as follows:

Question 1: Is the creativity of ideas from the groups that rely on pre-defined ideas more creative the groups who brainstorm on their own first?

Question 2: Do groups who rely on pre-defined ideas show higher satisfaction levels (i.e., are they more satisfied) than groups who brainstorm on their own first?

Participants and Task

Four, four person groups participated in this research. Research from Gallupe et al (1992) suggests that groups with four members are suitable for basing research on. The first two groups were comprised of undergraduate students and the second two groups were comprised of graduate students. The students were motivated to participate because 1) they were interested in the collaboration technology, 2) the task addressed campus issues in which they had a vested interest, and 3) they received monetary compensation, \$10 per participant for their time. Participants used the tool *GroupSystems*TM and were led through the task with the primary researcher as the facilitator and the secondary researcher as the technographer. The task centered on a campus issue of lack of parking and other parking problems on campus and possible solutions. The independent variable of the study is the process design which is either divergence before convergence or pre-defined divergence before convergence both discussed in the following sections. Additionally, the dependent variables are the number of unique solutions and the number of effective solutions which combine to determine the creativity of the solutions as well as the satisfaction of the participants.

Process Design 1: Divergence before Convergence

During this treatment participants spent 15 minutes prior to the convergence activity (i.e., FocusBuilder) diverging (i.e., brainstorming) on various solutions to the initial task problem. Groups then spent 45 minutes converging. One group of undergraduate students and one group of graduate students participated in this design.

Process Design 2: Pre-defined Divergence before Convergence

During this treatment participants did not spend time diverging (i.e., brainstorming) as they were provided with a set of pre-defined ideas before they began the 45 minute convergence activity (i.e., FocusBuilder). One group of undergraduate students and one group of graduate students participated in this design. The group of undergraduate students began with the ideas generated from the undergraduate group in process design 1 and the group of graduate students began with the ideas generated from the graduate group in process design 1. This was done so that the level of creativity from the beginning list was equal so as the output creativity could be compared across the groups equally. This is based on the assumption that the more creative the input the more creative the output. With this method, the input was of equal creativity.

Data Sources

Data was collected from multiple sources in order to enable rich understanding and comparison and contrast. The following four sources were used:

- *Session data (i.e., data logs from the GSS)*. The results of each group session were stored electronically. This output consists of all the contributions that the participants made during the convergence activity. These contributions are what were used to measure the creativity scores of participants.
- *Questionnaires*. Participants were asked to fill out a brief questionnaire at the end of each session that captured information about satisfaction. The instrument, mentioned above, is from Gallupe et al (1992).
- *Online feedback*. At the end of each session, participants were asked to respond to a series of questions in the GSS. These open ended questions solicited participants about their likes and dislikes of the experience.
- *Direct researcher observation*. Throughout each session, the researchers made notes of critical incidents and questions from participants relating to the session process and content.

RESULTS AND FINDINGS

Creativity

The research question regarding creativity asked: *Is the creativity of ideas from the groups that rely on pre-defined ideas more creative the groups who brainstorm on their own first?* To address this question, creativity scores were calculated using a combination of the number of unique solutions and the number of effective solutions based on research from Santanen, Briggs and de Vreede (2000). However, as one of the purposes of the

convergence activity is to reduce redundancies the number of unique solutions from each group was the same as the number of final converged ideas. Thus every final contribution was a unique contribution. Effective solutions were then calculated by two independent raters. Solutions were scored on a scale of 1 to 4 (1 = a solution that cannot be done or has no impact on the solution; 4 = a solution that is easily implemented and solves the problem completely). Based on research from Santanen, Briggs and de Vreede (2000), the two scores per solution were added and then the number 2 was subtracted. This means solution effectiveness can range from 0 to 6. Solutions with a score of 4 or greater are then considered effective. Table 1 shows the results of the creativity calculations.

# of Unique Solutions/Final Converged Ideas		# of Effective Solutions	
Process Design 1	Process Design 2	Process Design 1	Process Design 2
14	12	6	7

Table 1. Creativity Results

In terms of the number of unique solutions the lower the count the better. This is different from Santanen, Briggs and de Vreede (2000) due to the fact that their research was looking at a divergent task whereas we are looking at a convergent task. Then in terms of effectiveness the higher the scores the better as this means more solutions were found to be effective. The results show that participants who used process design 1 (i.e., divergence before convergence) produced slightly less creative solutions than participants who used process design 2 (i.e., pre-defined divergence before convergence). Therefore, as we expected groups who relied on pre-defined ideas were more creative possibly due to the fact that they were provided with examples to start with.

Satisfaction

The research question related to satisfaction asked: *Do groups who rely on pre-defined ideas show higher satisfaction levels (i.e., are they more satisfied) than groups who brainstorm on their own first?* To address this questions two survey questions were asked of the participants. Table 2 shows the results of the two survey questions from Gallupe et al (1992) in relation to the independent variable of process design.

Survey questions	Process Design 1	Process Design 2
Were you satisfied with the process used today?	6.25	6.63
Would you advocate this process for others to use to generate ideas?	5.88	6.00
<i>Scoring: 7-point Likert scale; “1” indicates Strongly Disagree and “7” indicates Strongly Agree</i>		

Table 2. Satisfaction Results

The results show that participants who used process design 1 (i.e., divergence before convergence) scored slightly lower on the satisfaction constructs than participants who used process design 2 (i.e., pre-defined divergence before convergence). This was as we predicting in that groups who are more creative will be more satisfied.

CONCLUSION

This study examines convergence under differing divergent starting conditions in order to identify techniques which could lead to more creative outcomes and more satisfied session participants. Specifically our research asked whether or not groups in a convergence activity are more creative and satisfied based on whether they start with pre-defined ideas (i.e., examples to start with) or brainstorm on their own first. The results of the lab experiment suggest that indeed groups who rely on pre-defined ideas when working on a convergence activity, specifically relying on the FocusBuilder thinkLet are both more creative and more satisfied than groups who brainstorm their own ideas to start.

In terms of implications for research and practice this study presents a step towards addressing the call for research of convergence in groups (Briggs et al. 1997; Davis et al. 2007; Hengst et al. 2007). Additionally, this study assists both facilitators and practitioners in improving the understanding of convergence thinkLets, specifically FocusBuilder.

One possible limitation of this study may be the small sample size. Only four total sessions were held (i.e., two for each process design) and therefore there are no statistically significant conclusions that can be drawn from this research. Nevertheless, the results do show that the accountability of ideas (i.e. ideas that session participants came up with compared with groups who start with pre-defined ideas) led to increased creativity and in turn increased satisfaction. Specifically, this study shows that groups who rely on pre-defined ideas were more creative possibly because they were provided with examples to start with. Additionally, the groups who relied on pre-defined ideas were more satisfied. In terms of future research, the results present a number of directions for study. For example, similar studies should be conducted in order to further confirm the findings of this work. If the same findings occur after more rigorous testing, the theoretical basis should be solidified. Additionally, future work should evaluate the differences in relation to the task that group members are converging on.

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