

*The Effects of Software Interaction Mode on Nominal Group Creativity in
Online Classes*

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Abstract

When students work together in a group in an online class, often times they work in a “nominal group”—a term used to address the situation when individuals work separately—rather than an actual group. This paper focuses on an electronic brainstorming task in nominal groups in online classes, where group members can work from their own location and generate ideas independently rather than sharing them with other group members. A facilitator, or one of the group members, is responsible for collecting and collating the ideas at the end of the brainstorming session. Some research has shown that nominal group can result in higher performance than actual groups. This paper also examines creative software interactive mode, the factor that is believed to influence group performance in electronic brainstorming, and its effect on idea creativity in nominal groups in online classes. There are two major software modes: graphic and outline, and users can switch between the two modes or stay with one mode. We aim to investigate how three different uses of the interaction mode (graphic, outline, and switching between the two) can affect group performance of online nominal groups. Group performance is assessed by four aspects of idea creativity (fluency, flexibility, elaboration, and originality). We believe that our findings will have an academic implication for educators who are teaching ever-growing online classes, as well as for researchers who are interested in electronic brainstorming or other Group Support System (GSS) tasks in different time/place settings.

Keywords: Nominal group, idea creativity, online classes, electronic brainstorming, software interactive mode

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Introduction

Students often work in groups when they are enrolled in a class, whether it is a traditional face-to-face or an online class, and students' group work often involves idea generation. Idea generation has been described as a process that produces a list of ideas—either by a group or by an individual. Of all the idea generation techniques, brainstorming is the most basic and most frequently used technique (Hender, Dean, Rodger, and Nunamaker, 2002). Brainstorming is the implementation of the free-thinking technique originally proposed by Osborn (1957). Researchers (Hender et al., 2002; MacCrimmon and Wagner, 1994) have reported that brainstorming is a useful technique for organizations seeking to be more innovative.

Several Group Support Systems (GSS) studies have investigated the impact of brainstorming tools in electronic brainstorming. The use of electronic brainstorming tools can resolve several issues, including anonymity and evaluation tone (Connolly, Jessup, and Valacich, 1990), group size (Gallupe, Dennis, Cooper, Valacich, Bastianutti, and Nunamaker, 1992), production blocking (Valacich, Dennis, and Connolly, 1994), and facilitator effects (Anson, Bostrom, and Wynne, 1995). Though past GSS studies have focused on different aspects of electronic brainstorming, none of these studies has investigated in depth the use of various software interactive modes in different group settings, the features that help facilitate the brainstorming process on nominal and actual brainstorming groups in online classes.

Electronic brainstorming can be done both in a virtual group and in nominal group. Nominal Group Technique (NGT) is a systematic approach to soliciting individual inputs into group project design and planning (Asmus and James, 2005). In online classes, students typically participate from different locations, whether synchronously or asynchronously, resulting in nominal group work rather than actual group work. Studies (Kramer, Fleming, and Mannis, 2001; McGlynn, McGurk, Effland, Johll, and Harding, 2004; Rietzschel, Nijstad, and Stroebe, 2006) have shown that nominal groups outperform face-to-face groups and generate more ideas than interactive groups. Also, the ideas generated by nominal groups are more original than the ideas generated by interactive groups. Like computer-mediated communication, NGT can be used to hide or avoid the identification of the source and thus reduce process loss or production blocking because the group members do not have to wait for their turn to contribute their ideas (Dennis and Reinicke, 2004).

This study addresses the software interactive mode and group settings as an important factor that influences idea creativity in both nominal and actual groups. In this context, group performance is assessed via four aspects of idea creativity: idea fluency, idea flexibility, idea elaboration, and idea originality.

Nominal Group Technique in Electronic Brainstorming

When it comes to group work, most people tend to think about actual groups rather than nominal groups. However, the concept of nominal groups has been examined in GSS research. The term “nominal group” is used to address the situation when individuals work separately (Gallupe and Cooper, 1993; Gallupe et al., 1992). In nominal brainstorming, group members can work in the presence of each other or work from their own location. The members generate their ideas independently rather

than sharing them with other group members, and a facilitator or one of the group members is responsible for collecting and collating the ideas at the end of the brainstorming session (Dennis and Reinicke, 2004). Thus, there can be very little or even no communication within the group in the idea generation stage. However, when a facilitator collects the generated ideas, she has to communicate with the other group members and the level of communication in this stage can be high or low.

Nominal group technique has several advantages over actual group technique. For example, all group members have equal opportunity to participate in the group activity and thus participation is balanced among group members (MacPhail, 2001). Production blocking and/or process loss cannot occur in the nominal group setting, and no one can dominate the group activity. Hence, both nominal group technique and computer-mediated communication (such as electronic brainstorming) have advantage of avoiding the blocking effect or the identification of the source (Pissarra and Jesuino, 2005). However, group members' evaluation apprehension depends on the structure of the brainstorming session. Evaluation apprehension will decrease if the ideas are submitted anonymously, and evaluation apprehension will increase if the ideas are not submitted anonymously (Dennis and Reinicke, 2004).

Several researchers have reported that nominal groups generate more ideas than actual groups. Dennis and Valacich (2001) pointed out that the synergy or cognitive stimulation that group members received in an [actual] electronic brainstorming group was an important difference between electronic brainstorming group and nominal group. Synergy is from the pool of ideas generated by and shared among the group members in electronic brainstorming. This is similar to the concept of group memory discussed by Satzinger, Garfield, and Nagasundaram, 1999. Nominal groups do not interact and thus do not have the synergy, cognitive stimulation, or group memory. However, Dennis and Valacich (2001) claimed that nominal groups generated as many or more ideas than [actual] electronic brainstorming groups for groups of eight or fewer members. Actual electronic brainstorming groups outperformed nominal groups only when there are nine or more members in the groups. Similarly, a study by McGlynn, McGurk, Effland, Johll, and Harding (2004) also reported that nominal groups of four individuals outperformed face-to-face groups of four individuals in brainstorming performance, yet the advantage of nominal groups declined when brainstorming took place later in the task where there was a large amount of accumulated evidence to consider.

A study by Dowling and St. Louis (2000) explored whether computer-assisted asynchronous (CAA) implementations of the nominal group technique (NGT) were as effective as noncomputer-assisted synchronous (NCAS) implementations of the nominal group technique. An experiment was performed to compare the outcomes for groups that used the nominal group technique both synchronously and asynchronously. Their study reported that computer-assisted asynchronous implementations of the nominal group technique were more effective than noncomputer-assisted synchronous implementations; that is, they generated more and better ideas in less time. According to these authors, the results implied that if meeting participants did not have to come together at the same time and were spending more time than was necessary in meetings, then organizations were wasting substantial economic resources in the form of travel expenditure and time spent arranging, traveling to, and participating in meetings.

Barki and Pinsonneault (2001) used four brainstorming technologies: nominal brainstorming, verbal brainstorming, electronic brainstorming-anonymous, and electronic brainstorming-non-anonymous, and compared the effectiveness of these technologies in terms of idea quality. In their study, nominal brainstorming sessions allowed each participant to generate ideas individually and keyboard them without interacting with other members of their group. The results indicated that nominal brainstorming groups generated ideas that were at least as good as electronic brainstorming groups. The authors explained that the participants might have perceived the brainstorming topics as being socially more or less sensitive depending on their individual experiences; that group members might have generated the connection and involvement as a group since they brainstormed four times during the experimental session, and ad hoc groups did not remain “purely ad hoc” after the first task; that the synergy and stimulation effects of electronic brainstorming might not actually be as strong as they were initially believed; and that small electronic brainstorming groups might not be able to produce ideas of better quality than small nominal brainstorming groups (Barki and Pinsonneault, 2001).

Other researchers have also reported similar results. For example, a study by Kramer et al. (2001) revealed that actual, face-to-face groups generated as many ideas as nominal groups when the face-to-face groups were assisted by a trained facilitator. Rietzschel, Nijstad, and Stroebe (2006) also indicated that nominal groups generated more ideas than interactive groups and the ideas generated by nominal groups were more original and less feasible than the ideas generated by interactive groups.

The aforementioned results seem to indicate that in participating in online class group work, nominal groups can result in greater performance than actual groups. However, we believe that it is appropriate to conduct our research on both nominal and actual groups in order to investigate the impacts of different software interactive mode in different group settings.

Software Interactive Mode

This study explores a specific feature of idea generation software, the software interactive mode, and examines how different software interactive modes affect the outcome performance of electronic brainstorming in nominal as well as actual group work in online classes.

Software Mode: Graphic and Outline

Different idea generation software provides different features; nevertheless, there are features they have in common. Examples include anonymity of group members, graphical aid in the brainstorming session, a tutorial on the problem-solving process, a storage area for recording ideas, etc.

Most creativity software contains a feature that organizes ideas in outline or graphic interaction mode. The software’s outline mode is a text-based configuration that facilitates users in prioritizing and rearranging ideas or topics by using notes text, toolbar, and checklist features. The graphic mode is a graphical configuration that includes diagrams, pictures, icons, symbols, arrows, etc.; hence, users can

differentiate the generated ideas with colors, shapes, patterns, shadows, fonts, and styles. The software's outline mode allows users to transform their thoughts into written statements, while the graphic mode enables users to create diagrams, concept maps, and transform their ideas into different graphic forms. The graphical aid, sometimes referred to as a "Diagram View," can help "visualize" the idea generation process and hence provides better understanding for the group members. The outline feature, referred to as an "Outline View," allows users to transform their thoughts into the foundation of written projects. Both graphic mode and outline mode are believed to result in clearer thinking, more creative projects, better organized writing, and improved group performance. Figure 1 shows the graphic and outline modes of a creativity software package.

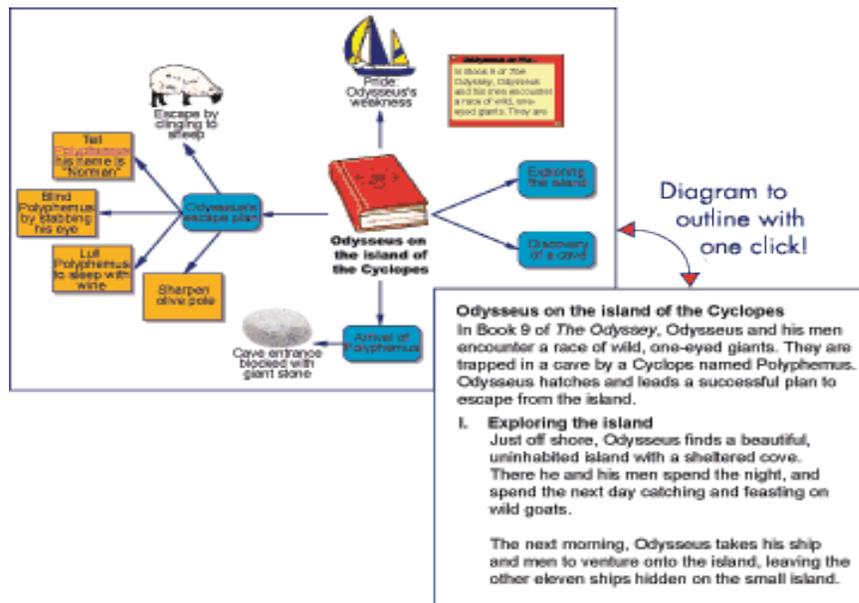


Figure 1: The Graphic/Outline Interaction Mode of Creativity Software.

Besides the problem statement and emerging pool of ideas, additional stimuli such as ideas generated and browsed by other group members can influence group members' creativity. Productivity can be increased by utilizing the stimuli that intentionally lead users' attention to different parts of the solution space (Hender et al., 2002). The software's graphic/outline mode can demonstrate the problem statement and the ideas generated by other group members, which can act as the creative stimuli for the creation of further ideas. A single stimulus often activates different associations across group members because each member has already developed a different set of associations, and the stimulus then exposures to others' ideas activates additional frames (Hender et al., 2002).

Madsen and Finger (1978) suggested that the written feedback procedure—group members generating ideas independently (as in nominal groups), receiving written copies of each other's ideas, and then resuming to work independently—yielded higher productivity than group brainstorming does. Similarly, a study by Paulus and Dzindolet (1993) indicated that performance levels in brainstorming groups were strongly affected by exposure to information about the performance of others, and that social matching of low performance levels by interactive group members might be an important factor in the productivity loss observed in group brainstorming.

In one experiment, presenting three subproblems instead of a combined intact problem resulted in an increase in three combined quantity/quality measures: number of unique ideas, total quality, and number of good ideas. In addition, the production of more unique ideas with a higher concentration can be achieved by providing verbal and visual cues—question derived from criteria for effective solutions (Hender et al., 2002)

Even though both graphic mode and outline mode are believed to enhance the performance of electronic brainstorming, the graphic mode is more visual than the outline mode and studies have shown that high visual subjects perform better than low visual subjects (Davis and Bostrom, 1992; Hawkins, 1999; Marinilli, 2003; Virvou and Kabassi, 2002).

Perception of Group Performance in GSS Research

Various measures of the performance of groups have been discussed in the literature. Some example are quality of group discussion (Benbunan-Fich et al., 2002); task completion (Fisher and Kingma, 2001; Holsapple and Joshi, 2002; Kamel and Davison, 1998; Lee, Strong, Kahn, and Wang, 2002) process satisfaction (Connolly et al., 1990; Mejias, Shepherd, Vogel, and Lazaneo, 1997; Miranda and Bostrom, 1999; Reinig, Briggs, Shepherd, Yen, and Nunamaker, 1996; Reinig 2003) and outcome satisfaction (Mejias et al., 1997; Huang, Wei, and Tan, 1999) However, this paper focuses on the idea generation task and proposes that idea creativity is an important indication of group performance in the idea generation setting. Idea creativity is discussed in the following section.

Idea Creativity

Creativity is defined as the quality of creating rather than imitating, and *creative ideas* are original rather than regular, newly created rather than “picked off the shelf” (Gautam, 2001). Sosik, Kahai, and Avolio (1998) define *group creativity* as a group’s divergent production of ideas and claim that researchers have paid much attention to group creativity when examining groups interacting in face-to-face meetings. There are four basic categories of divergent thinking: fluency, flexibility, elaboration, and originality (Sosik et al., 1998). *Idea fluency* is the number of ideas generated by groups, *idea flexibility* is the number of approaches used to produce solution units, *idea elaboration* is the number of comments that add detail of new features to a solution, and *idea originality* is the number of original solutions (Sosik et al., 1998). We assess idea creativity using all four aspects of divergent thinking.

Even though the notion that there is a positive correlation between idea quantity and idea quality has not yet been theoretically supported or empirically examined, researchers have proposed this relationship. While the notion of a constant proportion of high quality ideas to all ideas generated has yet been refuted, we believe it is acceptable to include idea fluency as one of the four dimensions of idea creativity.

Research Questions

This research suggests that group setting (nominal or actual) in online classes, as well as idea generation software interactive mode, can significantly influence idea creativity in electronic brainstorming—assessed by idea fluency, idea flexibility, idea elaboration, and idea originality. Our research model and research questions are stated below.

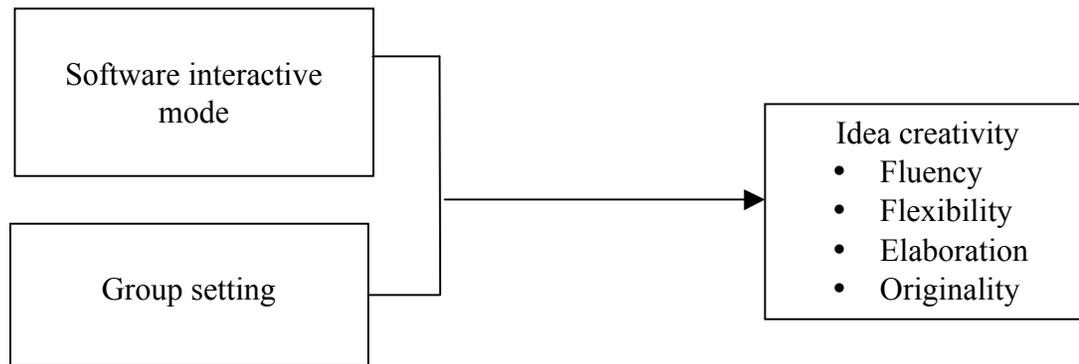


Figure 2: Research Model.

Question 1: How does idea generation software interactive mode (graphic/outline/switching between the two) affect group’s idea creativity?

Question 2: How does group setting (actual/nominal) affect group’s idea creativity?

Question 3: How does the interaction between idea generation software interactive modes and group setting affect group’s idea creativity?

Conclusion

This study focuses on the effects of the use of software interactive modes on different group settings—nominal and actual groups—in online classes. We plan to employ an experiment using undergraduate and graduate students enrolling in an online class and engaging in a specific idea generation task. Students will be randomly assigned to a nominal or an actual group. The idea generation software modes will be manipulated such that groups will be provided with graphic mode, outline mode, or switching between the two modes. In addition, idea creativity (idea fluency, idea flexibility, idea elaboration, and idea originality) will be assessed through existing measures in the GSS field (Connolly, Jessup, Valacich, 1990; Sosik, Kahai, and Avolio, 1998; Torrance, 1965), and data will be analyzed to identify the significant relationships within and between each experimental condition.

This study is not without limitations. First, this study assumes a one-time meeting of the electronic brainstorming groups while in reality there could be multiple meetings, which may increase or decrease the effectiveness of the brainstorming session. This repeated usage could create “group history” which affects group members’ interaction, perception, or sense of belonging to the group. A longitudinal study may provide different results (Giovagnoli and Romano, 2004; Huntley, 2003; Kemerer, 1992).

Another limitation is the use of university students. However, this study focuses in electronic brainstorming in online classes and university students are an appropriate group of users. We also employ a simple task (idea generation) and thus assumes that students can accurately represent business people that conduct electronic brainstorming in their job. Therefore, we believe that using students should have a negligible effect on the result's generalizability when applying the results of this study to practitioners outside of classroom.

We believe that the results of this experiment will have both practitioners and academic implications. Practitioners such as managers and educators can use the results of this study when brainstorming in different group settings (nominal and/or actual groups), especially in online classes. These practitioners will be able to identify the best software interactive mode (or a combination of modes) and best group setting, according to their group setting in order to achieve the highest degree of idea creativity. Researchers can further investigate the interaction and correlation between the software modes, group settings, and idea creativity. The results of this study can be used as a guide for future research in GSS-support activities such as multiple use of software, which will create group history. Future research can also examine different subject pools such as managers, designers, etc. instead of students. This stream of research can also help our understanding of group performance in both online classes and business settings.

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