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2005

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### Recommended Citation

Sutanonpaiboon, Janejira and Paul, Souren, "A Theoretical Framework of Creativity Software, Idea Creativity, and Group Satisfaction" (2005). *AMCIS 2005 Proceedings*. 9.

<http://aisel.aisnet.org/amcis2005/9>

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# A Theoretical Framework of Creativity Software, Idea Creativity, and Group Satisfaction

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## ABSTRACT

Idea generation software can be useful in electronic brainstorming and creativity tasks. Based on the theory of task/technology fit, we discuss two software features: graphic/outline mode and communication support, and propose that these features can improve group's creative performance in an electronic brainstorming task. We assess group's creative performance by idea creativity, which in turn can affect group members' satisfaction with the outcome of the electronic brainstorming session, and satisfaction with the electronic brainstorming process. We develop a theoretical framework to explain these relationships and state propositions associated with the research model. Practitioners can use the model to improve an electronic brainstorming session and researchers can extend our framework by exploring in depth the software interactive mode and communication support of idea generation software, and the interaction of both features.

## Keywords

Electronic brainstorming, creativity software features, idea creativity, process satisfaction, outcome satisfaction

## INTRODUCTION

Some published studies (Paulus, 2000; Sosik, Kahai, and Avolio, 1998) have shown that idea generation is an important part of the creative process in group works, and brainstorming is the most basic approach focusing on increasing groups' idea sharing (Hender, Dean, Rodgers, and Nunamaker, 2002). Researchers have examined various aspects of electronic brainstorming such as anonymity (Connolly, Jessup, and Valacich, 1990), production blocking (Gallupe, Dennis, Cooper, Valacich, Bastianutti, and Nunamaker, 1992), and group size (Gallupe et al., 1992). Nevertheless, these studies did not include characteristics of electronic brainstorming tools such as the graphic/outline mode of creativity software, and thus did not examine how the software modes affect group performance.

Most idea generation software contains a feature that organizes ideas in graphic/outline mode and a feature that facilitates group members' communication. The theory of task/technology fit (TTTF) argues that in an idea generation task, a Group Support System (GSS) should emphasize communication support to enhance group performance (Zigurs and Buckland, 1998). We examine the effects of the graphic/outline mode and communication support in idea generation software on group performance—assessed by group's idea creativity, process satisfaction, and outcome satisfaction. We start with a discussion on idea generation software, followed by the TTTF and the graphic user interface concept. We discuss four categories of idea creativity and link them with group satisfaction. Finally, we present four propositions and discuss the implication of the framework.

## LITERATURE REVIEW

### Idea Generation Software

Idea generation is recognized as a group process that produces a list of ideas, and idea generation software (electronic brainstorming) is designed to help stimulate user(s) to come up with new ideas and options (Turban, 2002). The software also provides *group memory*—the electronic capture of ideas generated by group members that is available for review (Satzinger, Garfield, and Nagasundaram, 1999) thus allows the group to view a wide range of ideas generated and explore a larger share of the problem space (Satzinger et al., 1999). Other studies (Gallupe et al., 1992, MacCrimmon and Wagner, 1994) have also shown that the use of creativity software in a GSS-based group provides a better creativity support for idea generation.

Most creativity software has a feature that presents ideas in graphic or outline forms. The outline mode looks like a Word document where users can rearrange ideas using text, toolbar, and checklist features. The outline mode helps transform users' thoughts into written statements, while the graphic mode helps users create diagrams and other graphic forms. Both modes can result in clearer thinking, better organized writing, and improved group performance. Figure 1 shows creativity software graphic/outline mode.

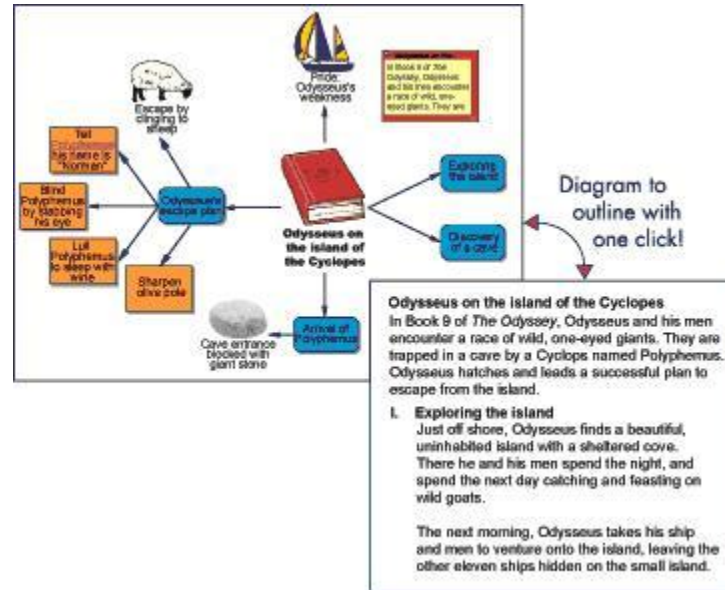


Figure 1. Creativity software graphic/outline mode

Besides the problem statement, additional stimuli such as ideas generated by other group members can influence group 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 graphic/outline view can demonstrate the problem statement and ideas generated, which can act as the stimuli for the creation of further ideas.

Like other GSS-supported tasks, an electronic brainstorming task depends on the GSS technology facilitating the task activities. Zigurs et al. (1998) develop the theory of task/technology fit in GSS environments based on attributes of task complexity and their relationship to relevant dimensions of GSS technology. We discuss TTF in the next section.

### Theory of Task/Technology Fit

Task/technology fit is ideal profiles composed of an internally consistent set of task contingencies and GSS elements affecting group performance (Zigurs et al., 1998). Idea generation task is considered a *simple task* due to its single desired outcome of generating many ideas, a single solution scheme (possible course of action to attain a goal), and no conflicting interdependence or solution scheme/outcome uncertainty.

TTF classifies GSS technology environment into three dimensions: *communication support* the aspect of the technology that supports, enhances, or defines the capability of group members to communicate; *process structuring*, the aspect that supports, enhances, or defines the process by which group interact; *information processing*, the capability to gather, share, aggregate, structure, or evaluate information. For an idea generation task, a GSS should provide primarily communication support so that group members can communicate their ideas about the solution to one another (Zigurs et al., 1998).

High communication support involves anonymity, parallelism, input feedback, and a group display, whereas low communication support environment lacks one or more of these features. Individual and group messaging are considered part of input display. The communication support dimension includes individual and group messaging, and the physical configuration of communication channels used by group members. In this paper we advocate the use of graphical mode of presenting ideas which is based on the use of graphical user interface which is discussed next in the paper.

## Graphic User Interface

A Graphic User Interface (GUI) is defined as a graphics-based user interface that integrates movable windows, icons and a mouse ([www.techweb.com/encyclopedia](http://www.techweb.com/encyclopedia)). The significant advantages that a GUI has over a character-based interface are its ability to resize application windows and change style and size of fonts. According to The Computer Language Company Incorporation, GUIs have become the standard way users interact with a computer (<http://www.computerlanguage.com/techweb.html>.) A GUI may be designed to eliminate possible distractions, provide informative feedback to users, avoid errors or make them easy to handle, or recover errors by promoting an exploratory interaction mode with the user interface. Therefore, a GUI can minimize the memory and cognitive load on users as well as provide users with memory aids or other cognitive supports (Marinilli, 2003).

A study by Davis and Bostrom (1992) shows that high visual subjects—users with the ability to manipulate or transform the image of spatial patterns into other arrangement, and construct a mental representation and run it—tend to perceive the system as easy to use and show improved performance. Users receive a quick overview of the information by displaying the appropriate relationships virtually, thus users can comprehend and assimilate it much easier than if it was presented as a list of retrieved items (Hawkins, 1999). We expect that the subjects employing superior GUI capability (i.e. the subject using the software's graphic mode) will obtain higher visualization and higher user interaction, and thus be more creative in idea generation than those using the outline mode.

Technology can significantly influence group-based idea generation outcome (Jessup, Connolly, and Galegher, 1990), and idea generation software interactive mode and communication support can be critical in determining how people exchange ideas, and hence can significantly impact group performance. We assess group performance in terms of idea creativity, group's process satisfaction, and group's outcome satisfaction.

## Idea Creativity

*Creativity* is 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 et al. (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).

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 (Potter and Balthazard, 2004; Barki and Pinsonneault, 2001). Potter et al. (2004) argue that the common purpose for brainstorming is to produce one or more high quality ideas, and the notion having a constant proportion of high quality ideas among all ideas generated in a session has yet been refuted. We, therefore, believe that idea fluency is an important dimension of idea creativity.

## Satisfaction

Practitioners and researchers have made the implicit assumption that satisfied users perform better than users with poor or neutral attitudes toward a system. Theoretically, satisfied users make better decisions and thus achieve a higher level of performance for an organization (Gatian, 1994).

Reinig (2003) presents a causal model of meeting satisfaction derived from goal setting theory, and distinguishes satisfaction with meeting outcome from satisfaction with meeting process. Both are a function of the degree to which the meeting is perceived to have contributed value through goal attainment. However, the distinction between outcome and process is necessary because it is possible that an individual could be satisfied with a meeting outcome and not satisfied with a meeting process, and vice versa (Reinig, 2003).

### *Process satisfaction*

A study by Mejias, Shepherd, Vogel, and Lazaneo (1997) argues that GSS technology should contribute to group achievement by eliminating communication barriers associated with face-to-face discussion; therefore, GSS-based groups can experience more process gains—including satisfaction—and fewer process losses. Other researchers have emphasized the importance of satisfaction with GSS-supported meeting process. Connolly et al. (1990) examine satisfaction with the process by which the group generate and evaluate ideas, with other members' evaluation of ideas, willingness to remain in one's current group, and how much fun overall working with one's group. Similarly, Reinig, Briggs, Shepherd, Yen and Nunamaker (1996) illustrate the importance of process satisfaction and indicate that a low process satisfaction may cause users to abandon GSS technologies, even if performance is increased.

Since GSS use has been shown to improve a meeting process, and good meeting processes can greatly enhance member satisfaction (Miranda and Bostrom, 1999), we believe that idea creativity resulted from a GSS-supported meeting process may have a direct linkage to users' process satisfaction.

#### *Outcome satisfaction*

In GSS-supported group meetings, outcomes vary according to the meeting's purpose. Meeting outcomes can include decisions, recommendations, or courses of actions, and can also be characterized as the absence of any specific accomplishment, which may or may not be consistent with an individual member's goals. Satisfaction with that outcome can be a goal itself in meetings that are held to accomplish a specific outcome. For instance, individuals faced with difficult decision to make often have the specific goal of being satisfied with their final decision. When such an outcome is obtained, a goal is fulfilled (Reinig, 2003). When outcomes are aligned with preferences, they are perceived as more favorable (Hunton and Price, 1997).

Outcome satisfaction provides a valuable indicator of the group's success since group members' satisfaction is likely to influence their confidence in the decision and their commitment to its successful implementation (Miranda et al., 1999). The data-generation and data-retrieval features of GSS technology can reduce uncertainty and thus evoke a feeling of comfort and outcome satisfaction (Mejias et al., 1997). The exchange of useful data can lead to a better quality outcome, which in turn lead to groups' outcome satisfaction (Huang, Wei, and Tan, 1999).

The goal of idea generation task is to generate many creative ideas which can be achieved with the use of idea generation software. We expect that group members who use idea generation software will be satisfied with process and outcome of the group task when the members generate a large number of creative ideas.

### **RESEARCH MODEL AND PROPOSITIONS**

As stated earlier, a GUI can provide users with memory aids or other cognitive supports and users can comprehend and assimilate information more easily if the appropriate relationship is displayed virtually. Additionally, high visual subjects tend to perceive the system easier to use and perform better than low visual subjects. Hence:

**Proposition 1:** Groups using idea generation software's graphic mode will have higher level of creativity than groups using the outline mode.

According to TTTF, group members will perform better if the idea generation tool provides communication support and thus allows users to communicate their ideas to one another. Hence:

**Proposition 2:** Groups provided with idea generation software's high communication support will have higher level of creativity than groups provided with low communication support.

Since the goal of an idea generation task is to produce as many creative ideas as possible, and idea generation software is expected to support generation of creative ideas, idea creativity can influence group members' satisfaction with the process and outcome of group task. Hence:

**Proposition 3:** Idea creativity will have a positive relationship with group members' process satisfaction.

**Proposition 4:** Idea creativity will have a positive relationship with group members' outcome satisfaction.

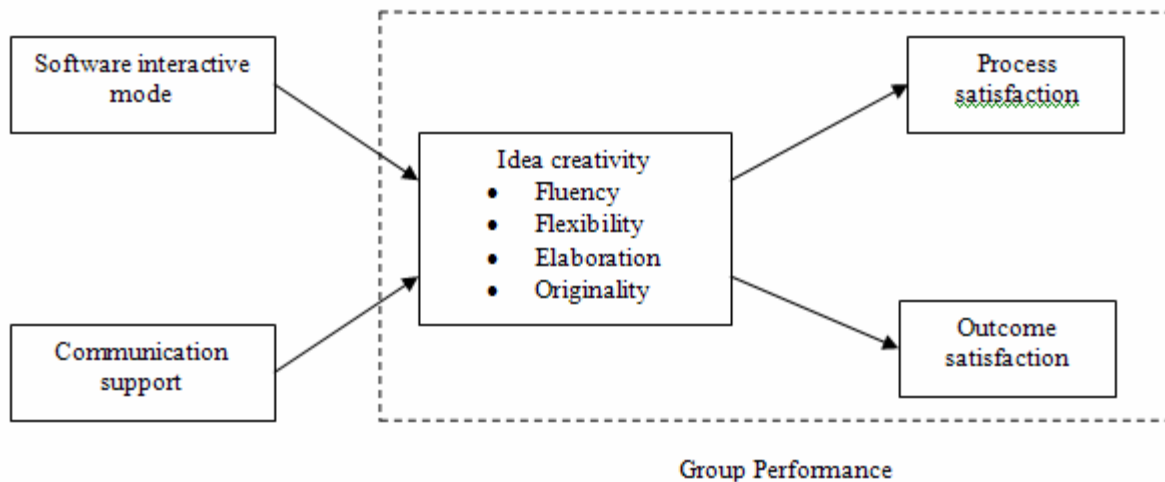


Figure 2. Research Model

## DISCUSSION AND CONCLUSIONS

This paper discusses creativity software interactive modes, communication support, and group performance in electronic brainstorming. The model presents the impact of software modes and communication support on idea creativity, process satisfaction, and outcome satisfaction. We plan to validate the model through a laboratory experiment. Group members will be engaged in an idea generation task and different modes of interaction and communication will be employed. Idea creativity will be assessed by analyzing the contents of ideas discussed by group members. Group members' satisfaction with process and outcome satisfaction will be assessed with the help of existing instruments.

Our research model is simple and does not take into account the group members' repeated use of idea generation software. Repeated, regular use of GSS involves issues concerning the appropriation of the tool (Dennis, Wixom, and Vandenberg, 2001). We plan to expand our model based on adaptive structuration theory (DeSanctis and Poole, 1994) and address the issues involved in repeated use of idea generation software.

We believe that our model is beneficial to practitioners and researchers. Practitioners can use the model to improve an electronic brainstorming session and researchers can extend it by exploring in depth the function of software mode, communication support, and the coordination of both features.

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