Group Size Effects in Electronic Brainstorming

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INTRODUCTION

Collaboration is a fundamental element of group brainstorming. Researchers have long considered how to improve collaboration to improve group brainstorming, but the general conclusion of this research is that due to problems in the communication process, people generate fewer ideas when they work together in groups than when they work separately and later pool their ideas (i.e., in "nominal groups") (Mullen, Johnson, & Salas, 1991; Paulus, Larey, & Ortega, 1995).

The goal of this brief article is to analyze the effect of group size on idea generation in both verbal and electronic brainstorming (EBS) groups. Group size effects were analyzed by a meta-analysis of 21 previously published articles. Section one reviews how group size impacts the communication process in group idea generation. Section two and three present the methods and results of our meta-analysis. Section four is a discussion of the results and implications for future research and practice.

BACKGROUND

Group brainstorming may be conducted several ways. Verbal groups allow participants to call out ideas simultaneously. Nominal groups encourage participants to first conduct individual brainstorming and compile separate lists of ideas. These ideas are then aggregated to compile a list of ideas. Finally, EBS groups use a variety of technologies to collaborate and generate ideas. EBS groups may be co-located or across time and space. In this article we compare the effect of group size on the number of ideas generated by each type of group.

Much prior EBS research follows the processes gains and losses framework (Hill, 1982; Steiner, 1972). Simply put, communication among group members introduces performance improvements (process gains) and restrictions (process losses) (see Table 1).

Potential Process Gains

Synergy is the ability of an idea from one participant to trigger a new idea in another participant, an idea that would otherwise not have been produced (Dennis & Valacich, 1993; Lamm & Trommsdorff, 1973).

Social facilitation is the ability of the presence of others to affect one's performance (Allport, 1920; Levine, Resnick, & Higgins, 1993; Zajonc, 1965). Social facilitation can have both positive and negative effects on performance (Robinson-Staveley & Cooper, 1990; Sanna, 1992).

Potential Process Losses

Production blocking refers to the need to take turns speaking in verbal brainstorming (Diehl & Stroebe, 1987). Production blocking is the single most important source of process losses in verbal brainstorming groups (Diehl & Stroebe, 1987; Gallupe, Cooper, Grise, & Bastianutti, 1994).

Evaluation apprehension may cause participants in verbal brainstorming to withhold ideas because they fear a negative reaction from other participants (Diehl & Stroebe, 1987; Lamm & Trommsdorff, 1973).

Anonymity has been shown to affect behavior in several studies (Diener, 1979; Saks & Ostrom, 1973; Siegel, Dubrovsky, Kiesler, & McGuire, 1986). Anonymity has influenced group participants to share ideas that might otherwise be withheld due to evaluative apprehension. Prior research on anonymity, however, is equivocal.

Social loafing is the tendency for individuals to expend less effort when working in a group than when working individually (Karau & Williams, 1993). Social loafing may arise because participants believe their

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Table 1. Potential process gains and losses

	Nominal Group Brainstorming	Verbal Brainstorming	Electronic Brainstorming
Process Gains			
• Synergy	None	Increases as the size of the group increases	Increases as the size of the group increases
• Social Facilitation	Depends upon group structure	Some effect	Some effect
Process Losses			
• Production Blocking	None	Increases with group size	None
• Evaluation Apprehension	None	Increases with group size	None
• Social Loafing	Depends upon group structure	Increases with group size	Increases with group size
• Cognitive Interference	None	Increases with group size	Some effect
• Communication Speed	Some Effect	None	Some Effect

contributions to be dispensable and not needed for group success because responsibility for completing the task is diffused among many participants (Latane, Williams, & Harkins, 1979).

Cognitive interference is in many ways the inverse of synergy. Cognitive interference occurs when the ideas generated by other participants interfere with an individual's own idea generation activities (Pinsonneault & Barki, 1999; Straus, 1996).

Communication speed is influenced by the need to type or write rather than speak. It is found in both nominal and EBS groups. For most people, speaking is faster than typing or writing so the need to type may inhibit idea generation by slowing down communication (Nunamaker, Dennis, Valacich, Vogel, & George, 1991; Williams & Karau, 1991).

THE ROLE OF GROUP SIZE

Group size is an important moderator of idea generation because the balance of process gains and losses changes depending upon the size of the group.

Verbal brainstorming groups experience process gains of synergy and social facilitation as the group size increases. But they also suffer from process losses that increase with the size of the group due to production blocking, social loafing, evaluation apprehension, and cognitive interference. Nominal group brainstorming experiences process gains from social facilitation but

no gains from synergy. Likewise, if nominal groups anonymously sum up the product of their work, they may experience some social loafing and communication speed problems, but no production blocking, evaluation apprehension, or cognitive interference.

EBS groups should experience synergy that increases with the size of the group as well as some social facilitation effects. EBS groups are also likely to suffer from cognitive interference, lower communications speed, and some social loafing that increases with group size.

Figure 1 offers a shorthand summary of these patterns. The figure does not attempt to display the detailed effects of individual process gains and losses on brainstorming methods, but merely indicates the overall trend effects for each method and the effects of group size. For example, overall process gains for both verbal and EBS groups should increase with group size to some threshold level where the value of adding another participant will be only minimally positive. Process losses in verbal brainstorming groups should increase fairly quickly as the size of the group increases; previous research suggests that losses increase more quickly than gains, because nominal groups have outperformed verbal brainstorming groups. It should be noted, however, that some of the process losses incurred by verbal brainstorming groups do not follow a linear trend. For instance, although the effect of evaluative apprehension should increase with group size, social impact theory (Latane, 1981) suggests that this effect will level off when the group reaches a threshold size.

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