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IMPROVING FACE-TO-FACE BRAINSTORMING THROUGH MODELING AND FACILITATION

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It has been demonstrated repeatedly that groups who brainstorm while interacting face-to-face (FTF) generate fewer ideas than nominal groups. Some researchers have suggested that there is little justification for groups to brainstorm FTF. Most of the results that support this conclusion have been obtained from laboratory groups working in artificial situations with little structure and no training, a situation quite different from most organizational settings. The purpose of this research was to determine if the use of trained facilitators, different recording techniques, and videotape modeling improved performance. The results of two experiments demonstrated that FTF groups generate as many ideas as nominal groups when assisted by a trained facilitator. Videotape modeling helps increase performance in some instances. Neither of two recording techniques affected performance. Because FTF groups can do as well as nominal groups, more research should identify mechanisms to improve FTF brainstorming, particularly because there are numerous potential benefits derived from interacting groups.

In a well-known series of experiments, Diehl and Stroebe (1987, 1991) investigated a number of potential explanations for the often-demonstrated effect that a nominal group of noninteracting partici-pants generates more ideas in a brainstorming session than an equal number of participants interacting face-to-face (FTF) in a group. They devised experiments based on the assumption that there are interaction processes that interfere with the effectiveness of the FTF groups that are not present in nominal groups. They investi-gated three of these processes: evaluation apprehension, social loafing, and production blocking. Although Diehl and Stroebe (1987)

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found evidence for the interacting effects of evaluation apprehension and social loafing, they later (1991) concluded that production blocking is the major cause of reduced effectiveness in brainstorming by groups interacting FTF. They went on to conclude that brainstorming by FTF groups is ineffective and that there is little justification for using them to brainstorm. They have continued this theme in their review article "Why Groups Are Less Effective Than Their Members: On Productivity Loss in Idea Generating Groups" (Stroebe & Diehl, 1994). Mullen, Johnson, and Salas (1991) came to a similar conclusion when they suggested that the "long-lived popularity of brainstorming techniques is unequivocally and substantially misguided" (p. 18).

Offner, Kramer, and Winter (1996) pointed out some clear omissions and limitations to most of the brainstorming studies reported up to that time. Most studies have been done with newly formed groups, the groups are given little direction or structure, no training is provided, they function without a facilitator, and they are given no visual aids such as a flip chart to use. They concluded that such research seems "totally divorced from reality and represents a clear 'disconnect' between research and practice" (p. 296). Sutton and Hargadon (1996) made similar observations, noting that almost all of the brainstorming research to date

> was done with participants who (1) had no past or future task interdependence; (2) had no past or future relationship; (3) didn't use the ideas generated; (4) lacked pertinent technical expertise; (5) lacked expertise in doing brainstorming; and (6) lacked expertise in leading brainstorming sessions. (p. 694)

In effect, these authors are identifying a number of threats to both the internal and external validity associated with the traditional laboratory approach to the study of brainstorming.

To a large degree, the research on brainstorming that attempts to determine why nominal groups do better than FTF groups is only looking at one side of the issue: the deficiencies associated with FTF groups. The reality is that FTF groups commonly engage in brainstorming as part of other activities such as problem solving (Offner et al., 1996; Paulus, Larey, & Ortega, 1995; Sutton &

Hargadon, 1996). A more productive approach would be to follow the suggestion of Hackman (1987), who proposed that researchers should not only determine what the barriers are to effective group process (i.e., production blocking) but identify strategies to improve group processes to enhance process gains associated with FTF groups. Given that groups routinely engage in brainstorming as part of other activities in organizations, Hackman's suggestion seems an obvious approach to improving the effectiveness of FTF groups.

In the past few years, attempts to improve the effectiveness of FTF groups have materialized. Paulus et al. (1995) had participants from a major corporation engage in brainstorming, both as part of a nominal group and as part of an interaction group. These participants had been given as much as 3 days of training in group dynamics as part of the change to a team culture, and a number of them had been trained to be group facilitators. Much to their surprise, Paulus et al. found the typical result: Nominal groups clearly generated more ideas than did FTF groups. They noted that although some of the participants had been trained as group facilitators, they were not asked to assume this role in the groups in this study. Paulus et al. observed that there had been no systematic studies investigating the benefits of facilitators in group brainstorming to date.

Offner et al. (1996) published the first systematic study investigating the effectiveness of trained facilitators on increasing the number of ideas generated by FTF groups in brainstorming. They also determined the effect of flip chart recording and the use of pauses within the brainstorming sessions. The results showed that groups with a trained facilitator generated significantly more ideas than those without a facilitator. The FTF groups with a facilitator were not significantly different from nominal groups in the number of ideas produced. Groups without a facilitator, however, performed in a typical fashion in comparison to nominal groups: They generated significantly fewer ideas. These results clearly suggest that the performance of FTF groups can be improved through the use of a trained facilitator. Oxley, Dzindolet, and Paulus (1996) subsequently produced a similar result. Other results from Offner et al. indicated that there was no difference in the number of ideas

generated by groups with a flip chart recorder compared to those that had no flip charting.

One purpose of the present study was to replicate the facilitator effect obtained by Offner et al. (1996). Specifically, it could be that the results achieved were specific to the facilitators used in that study and have little generalizability to other facilitators. Second, we wanted to investigate other variables that have the potential to enhance the performance of FTF groups as Hackman (1987) suggested.

PUBLIC RECORDING TECHNIQUES

A flip chart is an inexpensive and portable tool that may be used to foster synergistic process gains with real groups. Researchers have ignored the use of a flip chart as such a tool. Lack of such research has occurred despite the fact that many organizations commonly use a flip chart throughout the group problem-solving process, including the idea-generating stage. There is very little research on the effect that publicly recorded ideas of others have on FTF groups. Offner et al. (1996) found no effect due to the flip chart. They concluded that any gains due to the flip chart may have been offset by production blocking introduced by the flip chart–recording process itself. Although the flip chart recorder wrote down each idea stated, the members could not state more ideas because the recorder would fall behind. Also, it is possible that the members paid attention to what the recorder was writing rather than spending that time thinking of new ideas. This is similar to the blocking caused by the speaking of other members in the group, as described by Diehl and Stroebe (1987).

In an attempt to reduce blocking caused by flip chart recording, an alternative method of recording the ideas has been studied here. The method entails using computer-aided recording (CAR). The CAR method is a replacement of the traditional flip chart. CAR makes use of a computer, word processor, overhead projector, and an LCD monitor. The ideas are displayed on the screen as the recorder types. Devoe (1967) demonstrated that a good typist could

type 500 characters per minute, and the average person could print between 70 to 80 characters per minute. It is hypothesized that by using above-average typists, less time would be spent recording ideas, thus reducing the possible production blocking caused by flip chart recording. Members should not have to wait as long for the recorder to complete the previous idea and thus will be able to voice their ideas sooner.

FACILITATOR

A facilitator is a nongroup member who remains neutral while leading the group and makes sure the members use their time wisely. A facilitator may help increase group production by focusing the group, keeping the conversation flowing and balanced, and protecting individuals from personal attack (Doyle & Straus, 1982). Hackman (1987) explained that inappropriate weightings of member contributions must be minimized for a group to experience positive synergy. He further explained that groups must minimize slippage from their problem-solving strategies to experience positive synergy. The facilitator handles both of those needs by maintaining the balance of input from group members and keeping the members focused on the task at hand.

EXPERIMENT 1

The positive results obtained by Offner et al. (1996) and by Oxley et al. (1996) lend support to the possibility that facilitators contribute to the production gains of the group and therefore improve the brainstorming process. Offner et al. suggested that a facilitator may provide stimulation for participants to pay more attention to generating their own ideas rather than listening to others, thus counteracting production blocking. They further explained that this motivation might also counteract the effects of evaluation apprehension and free riding.

In summary, five hypotheses were tested in this study:

Hypothesis 1: Facilitated FTF groups will generate more ideas than nonfacilitated FTF groups.

Hypothesis 2: CAR FTF groups will generate more ideas than flip chart FTF groups.

Hypothesis 3: Facilitated FTF groups will generate as many ideas as nominal groups.

Hypothesis 4: Production blocking will be lower in FTF groups using the CAR than in FTF groups using flip charts.

Hypothesis 5: Facilitated FTF groups will maintain a more balanced level of participation than nonfacilitated FTF groups.

METHOD

PARTICIPANTS

Participants included 160 undergraduate students enrolled in psychology courses at Saint Louis University. They signed up for 1 of 40 sessions based on their own availability. The average age of the participants was 20 years. Females composed 61% of the participants. The facilitators were 5 graduate students. The flip chart recorders were 5 graduate students and 2 undergraduate students, and 4 graduate students assisted as computer-aided recorders.

DESIGN

A 2×2 factorial design was used for the FTF groups. There were 32 FTF groups, with 4 participants per group, with 8 groups per condition. The independent variables were the facilitator and recording method.

- Facilitator (present or absent): Half of the FTF groups had facilitators. The facilitators led the group, enforced the brainstorming rules suggested by Osborn (1953), and tried to motivate the group to generate ideas. The other half had no facilitator.
- Recording method (flip chart or CAR): 16 of the groups had a recorder print the ideas on a flip chart, and 16 of the groups had a recorder type the ideas using CAR.

For comparison, 8 nominal groups with 4 participants per group were run as a standard against which to compare all the FTF groups.

The main dependent variable was the number of ideas generated. This was measured by the number of ideas listed on the flip chart sheets for the flip chart groups and the number of ideas listed on the word processor for the CAR groups. Responses to questionnaire items administered after the brainstorming session also were measured and evaluated.

FACILITATOR AND RECORDER TRAINING

For training purposes, 12 students, 6 males and 6 females, were trained in two 2-hour sessions before the study began. The training and supporting materials were virtually identical to those used by Offner et al. (1996).

CAR RECORDER TESTING

The recorders were required to be able to type at least 300 characters per minute (60 words per minute). They were tested on a computer software program that calculates typing speed.

EQUIPMENT

In the flip chart condition, flip chart paper was posted in front of the group. The recorders used black poster markers. When each page was filled, masking tape was used to hang the pages on the nearest wall facing the participants.

In the CAR condition, the participants sat in a semicircle facing an overhead screen. Sitting in front of the participants, just to the left of the screen, were a laptop personal computer and the recorder. The ideas were projected onto the screen in front of the participants using an overhead projector and an LCD display.

Participants in the nominal group condition were provided with an 8.5×11 inch pad of paper and a pen.

QUESTIONNAIRE

A questionnaire, based on one developed by Offner et al. (1996), was used to assess basic demographic information, level of satisfaction, balance of group participation, and level of involvement in the task. Seven questions, developed by Dennis and Valacich (1993), were added to this questionnaire to measure production blocking, evaluation apprehension, free riding, and participants' estimates of sufficient time to complete the task. The questionnaire included, when appropriate, a checklist of facilitator behaviors, a checklist of recorder behaviors, an assessment of the legibility of the group record, and participants' interpretations of the effect of the group record.

PROCEDURE

Participants signed up for 1 of 40 sessions. When the participants arrived for their session, they were randomly assigned to one of the four FTF group conditions or to the nominal group condition.

The FTF groups were made up of 4 participants and (a) one flip chart recorder, (b) one CAR recorder, (c) one facilitator and one flip chart recorder, or (d) one facilitator and one CAR recorder.

To start the session, the facilitator in facilitated groups and the recorder in nonfacilitated groups read from a script, which informed the group members of the task and the brainstorming rules. The assistant instructed the group members to brainstorm in a 4-minute practice session on the topic of how to improve attendance at Saint Louis University's basketball games. After the practice session, the assistant instructed the participants to brainstorm for 20 minutes on the topic of how to improve campus safety and security at Saint Louis University.

After the brainstorming session, the participants completed the questionnaire and were asked to read the debriefing statement after which they were excused.

The nominal group members were seated in separate rooms. Each was given a pad of paper and a pen and instructed to brainstorm individually on the same practice problem for 4 minutes and then instructed to brainstorm on how to improve campus safety and

TABLE 1: **Group Means and Standard Deviations for the Number of Ideas Generated in Brainstorming as a Function of Facilitation and Recording Method**

Condition	M	SD
Facilitator and flip chart	69.3	14.8
No facilitator and flip chart	49.5	14.6
Facilitator and CAR	79.4	30.1
No facilitator and CAR	49.1	12.6
Nominal group	69.8	24.1

NOTE: Number of groups per condition = 8; CAR = computer-aided recording.

security for 20 minutes. After the brainstorming session, the participants filled out the questionnaire, read the debriefing statement, and were then excused.

Nominal groups were created by randomly assigning the individual's brainstorming ideas to 1 of 8 groups. An experimentally blind assistant, who copied the ideas of the nominal groups word for word, created a single list of each nominal group's ideas. An experimentally blind rater then deleted any repeated ideas from the list. Using this process, the rater determined the number of nonredundant ideas created. A second rater repeated the procedure. Using Diehl and Stroebe's (1987) formula to measure interrater agreement, it was found that the raters agreed in 99.95% of the total number of possible pairs.

RESULTS

QUANTITY OF IDEAS: FACILITATION AND RECORDING METHOD

The hypotheses regarding the comparison of productivity among the FTF groups were tested using a 2×2 factorial ANOVA. The dependent variable was quantity of nonredundant ideas generated as determined by two experimentally blind raters. The means and standard deviations for all conditions are shown in Table 1.

The results indicated a significant main effect for facilitator presence, $F(1, 28) = 13.38$, $p < .01$. The mean quantity of ideas for facilitated groups was 74.31, and the mean quantity of ideas for

nonfacilitated groups was 49.31. Thus Hypothesis 1, which stated that facilitated groups would generate more ideas than nonfacilitated groups, was supported. CAR groups averaged 64.25 ideas, and flip chart groups averaged 59.37 ideas. Even though CAR groups did average more ideas, the difference was not significant. Therefore, Hypothesis 2, which stated that CAR groups would generate more ideas than flip chart groups, was not supported. The interaction of recording method by facilitator presence was not significant.

FTF GROUPS COMPARED TO THE NOMINAL GROUP

The quantity of ideas produced by each FTF group condition was compared to the quantity of ideas produced by the nominal group condition. Nominal groups ($M = 69.81$) outperformed nonfacilitated groups ($M = 49.31$), $t(22) = 2.75$, $p < .01$. These results are as expected. A t test comparing nominal groups ($M = 69.81$) to facilitated groups ($M = 74.31$) resulted in $t(22) = 1.72$, $p > .05$. Therefore, facilitated groups generated as many ideas as nominal groups, as hypothesized. This demonstrates that with a facilitator, FTF groups can perform as well as nominal groups.

QUESTIONNAIRE

The questionnaire items were used to test the last two hypotheses and to provide further understanding of the brainstorming process under the various conditions.

Production blocking. It was hypothesized that CAR would result in less production blocking than flip chart recording would. A 2×2 (Facilitator Presence $\times$ Recording Method) ANOVA was conducted on two items of the questionnaire. Both asked the respondents to describe on a 7-point scale how soon they were able to express their ideas. A rating of 1 = *immediate expression of the idea*, and 7 = *a long wait before expressing the idea*. For both items, CAR groups were able to express their ideas sooner than flip chart groups. For the first item, the reported mean of the CAR groups was 1.92, and the reported mean of the flip chart groups was 2.42,

resulting in $F(1, 124) = 6.55$, $p < .05$. For the second production-blocking item, the reported mean of the CAR groups was 1.75, and the reported mean of the flip chart groups was 2.16, resulting in $F(1, 124) = 4.46$, $p < .05$. Therefore, although both groups reported that they could respond without much of a wait, the CAR groups reported that they felt they did not wait as long as the groups using the flip chart.

Balanced participation. It was also hypothesized that the facilitator would help maintain a balance of participation among group members. One item on the questionnaire asked participants to rate the balance of participation demonstrated by the group members on a 7-point scale (1 = *group dominated by one individual*, and 7 = *equal participation*). Facilitated groups (*M* = 5.16) did not report more balanced participation than nonfacilitated groups (*M* = 5.36). Therefore, Hypothesis 4 was not supported.

Sufficiency of time. One item inquired about having sufficient time allotted for the task (1 = *having time to express all your ideas*, and 7 = *not having time to express all ideas*). Nonfacilitated groups (*M* = 1.39) felt as if they had time to express all their ideas, and facilitated groups (*M* = 1.95) also felt they had time but to a lesser degree, $F(1, 124) = 7.63$, $p < .01$.

Evaluation apprehension. Two items measured the participant's level of evaluation apprehension. CAR groups reported being more at ease for both items; however, this difference was only significant on one item. The question asked participants how much apprehension they felt during the brainstorming session (1 = *a lot of apprehension*, and 7 = *no apprehension*). CAR groups (*M* = 6.00) indicated less apprehension than flip chart groups (*M* = 5.28), $F(1, 124) = 6.54$, $p < .05$.

Recorder and facilitator behavior. Chi-square tests were used to analyze questionnaire responses about behaviors demonstrated by the recorder. All frequencies for the recorder behaviors were in the expected direction and yielded significant chi-square results, $p <$

.001 unless otherwise stated. Participants did not feel that the recorder "abstained from recording," "made judgments about what was important to record," "put words into people's mouths," or "record[ed] too much." Not one participant thought the recorder recorded too slow. They did think that the recorder "captured the basic ideas" and "stayed neutral." Of the groups, 92% of the CAR groups and 73.4% of the flip chart groups believed the recorder captured the basic idea. Reportedly, the CAR groups did a better job at capturing the basic idea, $\chi^2(1, 106) = 7.90, p < .05$. There is no discernible reason for this to have occurred.

Regarding the written or typed record of the ideas, participants believed that the "words were legible" and that the recorder "aided in the development of more ideas." The participants did not feel that the "record distracted from the process of idea development."

The remaining facilitator behavior statements were significant ($p < .001$) and in the expected direction. Facilitators "encouraged all members to participate," "motivated the group to generate ideas," and "stayed neutral." The facilitator did not "make judgments about the quality of the group's ideas" or "give own suggestions on how to improve campus safety and security."

DISCUSSION

The purpose of this study was to investigate the impact of a facilitator and two recording methods on the productivity of brainstorming groups. The aim was to reduce the presumed process loss of production blocking by using CAR and to increase the process gains by managing the group process with a facilitator.

FACILITATOR

As anticipated, facilitated groups outperformed nonfacilitated groups. In addition, facilitated groups generated slightly, but not significantly, more ideas compared to nominal groups. This result verifies that FTF groups can improve their performance to at least the level of nominal groups through the use of a trained facilitator.

We thought that facilitators would motivate members, encourage participation, balance member contributions, and generally lead the group through the brainstorming process. Participants in facilitated conditions indicated that the facilitator encouraged participation and motivated the group to generate ideas. However, the questionnaire data did not indicate that facilitated groups enjoyed more equal member participation than nonfacilitated groups. It appears that it is the motivation a facilitator provides that enhances the group's performance.

RECORDING METHOD

In this study, the CAR method was introduced to overcome the potential production blocking from flip charting that Offner et al. (1996) proposed and to therefore be able to take advantage of the benefits of a record. The results of this study indicate that the perceived production blocking was slightly reduced by using CAR. However, the CAR groups did not generate a statistically significant greater number of ideas than the flip chart groups.

It remains questionable whether the CAR method overcomes the assumed production blocking introduced by the flip chart recording process. It seems logical that if recorders can type faster than they can write that less production blocking would occur in the CAR groups. The participants did indeed report less blocking. Perhaps, there was less blocking but not enough to have a significant impact on production.

It also remains questionable whether groups obtain any benefit from having a group record of ideas. If the CAR groups had as little production blocking as the nominal groups (as reported), then why did they not benefit from the presentation of other member's ideas and outperform nominal groups? Perhaps, the record of ideas does not assist the group in the production of more ideas. Past research has shown that providing individuals with a list of ideas does not stimulate them to generate more ideas (Connolly, Routhieux, & Schneider, 1993; Madsen & Finger, 1978). Small electronic brainstorming groups, similar in size to the groups in this study, did not benefit from seeing other individuals' ideas. How-

ever, large electronic brainstorming groups did benefit from seeing other's individual ideas (Dennis & Valacich, 1993). Perhaps, large group sizes are necessary for members to benefit from the record of ideas.

Also of interest is whether the written record helps provide feedback and motivation for generating solutions. Roy, Gauvin, and Limayem (1996) discussed the motivating factor of the feedback provided by a "public screen." In their study, individuals who had a screen displaying the group's ideas and individuals who were told they would see a list of ideas produced by the group after the brainstorming session produced more ideas than those without any group memory. Roy et al. suggested that the record provides members with feedback on how their performance compares to others and motivates them to generate more solutions. Clearly, the group memory has some effect, and further research is warranted.

EXPERIMENT 2

The results of the first study replicate the findings of Offner et al. (1996) showing the advantage of using a trained facilitator. However, displaying the brainstormed ideas, whether by flip chart or CAR, did not create a sizeable advantage. How else might we improve brainstorming in FTF groups?

Research in social learning has shown that models can have powerful effects on individuals in a variety of settings (Bandura, 1969; Walter & Miles, 1972) for a variety of reasons. Flanders (1968), for example, showed that participants imitate the behavior and expressions of models they observe. In addition, the more similar the observer's task is to that of the model, the more likely imitative behavior will take place.

Bandura, Ross, and Ross (1963) found no difference in the performance of observers after watching live, filmed, or televised model performance. However, the impact of modeling overall was quite apparent. Walter and Miles (1972) showed that modeling through videotape presentations had significant effects on the behaviors of problem-solving group members. Model group pre-

sentations were shown to increase productivity through positively affecting various group process–oriented behaviors. These included increasing the number of questions asked by the group members of each other, decreasing the number of negative statements, and decreasing the level of inhibiting behavior.

Dillon, Graham, and Aidells (1972) investigated the relative and combined effects of videotape training and practice on the brainstorming performance of groups. They expected to find that the performance of both nominal and FTF brainstorming groups would improve after watching videotape of a well-trained group when compared to groups who watched no videotape. Their results showed the typical finding: Nominal groups outperformed FTF groups. There was also an effect due to the videotape training but in the direction opposite of that hypothesized. Groups who did not view the videotape of the smoothly functioning group outperformed those who did view the tape. The authors speculated that those viewing the videotape may have been overwhelmed by the ability of the smoothly running group to perform so well. Trying to perform to a high standard may have in fact interfered with their performance.

The present study investigated the effect of using videotapes to affect the performance of FTF brainstorming groups. Because of the results found by Dillon et al. (1972), we used two videotapes: one of a smoothly functioning group and another of a poorly functioning group. Our thinking was that a videotape presentation of a group performing poorly and not adhering to good group-process principles would make the errors easily identifiable and thus easier from which to learn. This parallels the suggestion of Bandura et al. (1963) who suggested that the more realistic a model is the greater the ability of participants to learn from the model.

The purpose of this study was to continue to investigate variables that could improve the performance of FTF brainstorming groups through the use of videotape training and the use of a facilitator. The hypotheses were:

> *Hypothesis 1:* Facilitated groups will outperform those without a facilitator in terms of quantity of ideas.

Hypothesis 2: Groups that receive training with negative models will outperform groups that receive no modeling through videotape and groups that receive positive modeling through videotape.

Hypothesis 3: Groups that receive no modeling through videotape will outperform groups receiving positive modeling through videotape.

Hypothesis 4: Facilitated groups that receive negative modeling training will outperform all groups.

METHOD

PARTICIPANTS

Participants were 120 undergraduate students enrolled in psychology classes at Saint Louis University. Groups were made up of 4 members each, with a minimum of 1 member per gender. The facilitators were 5 graduate students. The average age of the participants was 20.62; 75% were female.

DESIGN

The study was a 2×3 factorial design. A total of 30 groups composed the study. The independent variables were videotape training (positive, negative, or absent, with 10 groups per condition) and facilitator (present or absent).

VIDEOTAPE DEVELOPMENT

For the videotapes, 4 undergraduate students with prior knowledge of small group behavior were trained intensely in the basic principles of group brainstorming. The group was videotaped under two conditions. For the positive videotape, the group was asked to display three specific acceptable facilitating behaviors and to avoid three specific unacceptable disruptive behaviors (see Table 2 for the specific behaviors). For the negative videotape, they were asked to do the opposite.

TABLE 2:   Mean Participant Ratings and *F* Value of the Extent to Which Various Behaviors Were Present in the Positive and Negative Videos

Type of Behavior	Positive Video	Negative Video	F Value
Positive			
The members in the model group paraphrased, combined, and improved on each other's ideas.	3.60	1.78	128.05*
They participated equally.	2.50	0.73	96.44*
They freewheeled in idea generation.	3.50	2.03	53.89*
Negative			
They interrupted each other.	0.68	2.55	82.25*
They used killer phrases.	0.20	2.80	207.59*
They were negative and used evaluative comments.	0.28	3.15	299.35*

*$p < .001$.

Once produced, 10 graduate students with training in small group behavior and facilitation viewed the tapes and rated them to ensure that the target behaviors were indeed present in the tapes.

FACILITATOR TRAINING

As in Experiment 1, 5 graduate students were trained to fill the role of facilitator. None of the facilitators in this study had participated as facilitators in Experiment 1.

PROCEDURE

The experimenter determined which condition was to be implemented for each session. Students volunteered to participate without any knowledge of the kind of group session they would experience. All groups received a brief explanation of the rules of brainstorming followed by an 8-minute warm-up brainstorming session. Then, participants in the videotape conditions watched the videotape of either the positive group or the negative group. Participants were given a description of the six specific behaviors targeted in the tapes. After viewing the videotapes, these participants filled out a questionnaire about what they saw in the film as a manipula-

tion check. Groups in the no-training condition did not view any videotape.

At this point, all participants were instructed to brainstorm as a group for 20 minutes by providing ideas to the question of how would you improve campus security and safety at Saint Louis University? All sessions were audio taped. Following the sessions, participants completed a postsession questionnaire, which assessed the participants' perceptions of the facilitator's effectiveness (where appropriate), their perceptions of videotape effectiveness, and their satisfaction with the group's processes. Finally, participants were debriefed and released.

RESULTS

VIDEOTAPE QUESTIONNAIRE

The data from the completed participant questionnaires, taken after viewing the training films, were analyzed by comparing the means of those exposed to the positive films with the means of those exposed to the negative films for both the presence or absence of the three positive and three negative behaviors. Table 2 shows mean rating for the degree to which the positive and negative behaviors were present in the positive video and in the negative video, along with the results of ANOVA for each behavior. All comparisons are significant at $p < .001$ in the predicted direction. Clearly, the videotapes portrayed the behaviors as intended.

RELIABILITY OF SCORING

Ideas for each of the 30 group sessions were transcribed from the audiotape recordings of each session by two independent raters. Each listened to 10 of the 30 sessions individually and listed the total number of ideas heard for each group. The interrater reliability was .96 ($p < .01$). Each rater then listened to 10 of the remaining 20 taped sessions and listed the total number of ideas heard for each group.

TABLE 3: **Group Means for the Number of Ideas Generated in Brainstorming as a Function of Facilitation and Type of Video Training**

Condition	Type of Video			Total Mean
	Positive	Negative	None	
Facilitator	55.0	66.0	66.6	62.5
No facilitator	31.4	49.2	29.8	36.8
Total mean	43.2	57.6	48.2	

QUANTITY OF IDEAS

The number of ideas identified by each rater on the last 20 tapes and the average of the two ratings on the first 10 tapes served as the dependent variable. The mean number of ideas produced by groups in each condition is summarized in Table 3.

Pairwise comparisons were conducted to test the hypotheses. As predicted, it was found that the main effect for the facilitator was significant, $t(28) = 4.75$, $p < .001$ (all t tests are one tailed given the directional hypotheses). Concerning the videotaped training, groups trained with the negative model produced significantly more ideas than those trained with the positive model, $t(18) = 2.04$, $p < .05$. Neither the positive video nor the negative video condition was significantly different from the no-video condition. However, within the no-facilitator condition, groups who received training with the negative model outperformed both the groups that received training with the positive model, $t(8) = 2.50$, $p < .05$, and the groups that received no training, $t(8) = 2.75$, $p < .05$.

FACILITATOR BEHAVIOR

Participants in the facilitated condition filled out a checklist of behaviors indicating which ones applied to the facilitator for their group. The results indicate that the facilitators performed along the lines expected. They "guarded against disruptive behavior" (67%), "kept the group momentum going" (85%), and "remained neutral" (83%). They avoided some other behaviors that are inconsistent with the facilitator role: "talked too much" (3%), "evaluated the ideas presented" (17%), and "became part of the brainstorming

process" (30%). Overall, the facilitators implemented their role as trained.

DISCUSSION

One purpose of this study was to replicate the effect that facilitators have on the brainstorming effectiveness of FTF groups. This is the second independent replication of the effectiveness of using a facilitator. FTF brainstorming groups perform significantly better with a facilitator compared to similar groups without a facilitator.

A second purpose of Experiment 2 was to investigate another variable that might help improve performance of FTF brainstorming groups. As hypothesized, groups shown a videotape demonstrating behaviors to avoid during a brainstorming session performed significantly better overall than those groups shown a videotape demonstrating positive behaviors. This effect was much more prominent with participants in the no-facilitator conditions. Here, the groups who where shown a negative video of behaviors to avoid performed better than both those shown the positive film and those who received no training. Two implications flow from these results. Why was the film showing behaviors to avoid more effective than the film demonstrating behaviors to implement? It may be that in this situation, it is much easier cognitively and/or behaviorally to simply avoid certain fairly simple behaviors. This parallels the suggestion of Bandura et al. (1963) that the more realistic a model is the greater the ability of participants to learn from the model.

Second, the use of the facilitator reduces or mediates the effectiveness of the videotapes. In all likelihood, the facilitator also acted to reduce some of the negative behaviors because these same negative behaviors were mentioned as part of the facilitator training as behaviors to control.

SUMMARY AND CONCLUSION

The results of these studies combined with those of Offner et al. (1996) make it clear that the use of a trained facilitator significantly increases the performance of FTF brainstorming groups. Offner et al. also showed that facilitated FTF brainstorming groups did about as well as nominal groups. In Experiment 1, the facilitated FTF groups did slightly better than the nominal groups of Offner et al. In Experiment 2, informal comparison indicates that the facilitated FTF groups again did about as well as the nominal groups of Offner et al.

Why do facilitated groups do better than nonfacilitated groups? The answer to this question is not completely clear. Although the facilitator may help even out participation, this did not seem to be a major factor as shown in Experiment 1. Informal observation of effective facilitators in our two studies suggests that they fall into two categories: those who maintain a tight procedural structure for the groups and those who are motivational and bring energy to the situation. Facilitators who focus on the procedural rules are good at holding off evaluation of ideas, preventing interruptions, indicating that there is a lot of time left, and asking participants for additional ideas. The motivational facilitators may do the same but in addition make statements that encourage creativity, ask groups to "do your best" and build on each other's ideas, and are generally energetic themselves.

What mechanism might the facilitator be affecting? Production blocking has been implicated as a major barrier to FTF brainstorming. Facilitators may be "pushing" or motivating participants to focus on their own thoughts rather than what others are saying. If so, then this might dampen the presumed distraction caused by the ideas produced by others (cf. Diehl & Stroebe, 1991). Questionnaire data from Experiment 1 tend to support this suggestion. Facilitated groups felt that they had somewhat less time to express their

ideas than the participants in the nonfacilitated conditions. They may have felt pressure from the facilitator.

Facilitators clearly encourage each member to produce additional ideas. This form of encouragement may help overcome the tendency to loaf or free ride. Facilitators often say things such as "good idea" or "let's hear some more." This helps overcome the norm of matching or averaging output and encourages each individual to produce as much as he or she can. It may also reduce social loafing for the same reason. The encouragement of the facilitator may also act to overcome evaluation apprehension, particularly when the facilitator socially reinforces an idea by comments such as "good idea." Other studies might be designed to focus more clearly on what mechanism the facilitator is affecting. This might also clarify more precisely which behaviors of the facilitator are the most effective.

Data from Experiment 1 and the results of Offner et al. (1996) suggest that external recording of ideas, either on a flip chart or by way of CAR, does not help or stimulate a group to produce more ideas. Connolly et al. (1993) showed that participants in brainstorming are not stimulated to build on the ideas of others when they see them. Our own observations of problem-solving groups suggest that participants seldom look at the material displayed on the flip chart that they have generated. Although the flip chart may have other benefits (cf. Doyle & Straus, 1982), it does not seem to assist in brainstorming.

Both Diehl and Stroebe (1991; Stroebe & Diehl, 1994) and Mullen et al. (1991) suggested that FTF brainstorming is ineffective and should not be used. However, Sutton and Hargadon (1996) nicely demonstrated how FTF brainstorming groups are valuable in a variety of ways beyond just the quality and quantity of ideas generated. They and Offner et al. (1996) showed how most of the research that questions the effectiveness of FTF brainstorming groups is severely lacking in both internal and external validity. For example, most laboratory groups are given no structure to follow and no training. The group members have no real interdependence, have no past or future relationship, and do not use the brainstorming ideas generated.

Because FTF brainstorming is widely used, it seems much more productive to learn how to continue to increase the effectiveness of such groups. This study and others (Offner et al., 1996; Oxley et al., 1996) have demonstrated that the performance of FTF brainstorming groups can be improved through facilitation and training and that they can perform at least up to the level of nominal groups. Additional research should focus on (a) increasing the external validity of brainstorming research by more closely simulating how brainstorming is actually carried out in work settings, (b) investigating other ways to improve FTF brainstorming as demonstrated in this study, and (c) exploring other positive effects of FTF brainstorming. For example, it is very plausible to assume that the interaction involved in FTF brainstorming will carry over into subsequent steps in a problem-solving process when brainstorming is only one step in that process. Cohesion, group efficacy, and the development of transactive memory (Wegner, 1986) are just a few of the mechanisms that can be affected in FTF brainstorming that cannot occur with nominal groups.

It is regrettable that Diehl and Stroebe (1991; Stroebe & Diehl, 1994) and Mullen et al. (1991) suggested that FTF brainstorming should not be used. For example, Thompson (1999) reiterated the recommendation of Diehl and Stroebe in a recent book on team building even though she cited the work of Offner et al. (1996) and Sutton and Hagaden (1996). The inadvisability of using FTF brainstorming groups is presumably accurate for groups working in artificial situations given little structure, no facilitation, and no training. To have groups and teams operate in this way, however, within an organizational context in today's competitive world would be wasteful and unusual. Training and facilitation are the norm, not the exception. More research on how to improve FTF brainstorming and on the added benefits that can be achieved is what is needed.

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