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A comparison of brainstorming and the critical evaluation method of problem-solving

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San Jose State University, 1990

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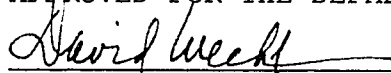
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METHOD OF PROBLEM-SOLVING

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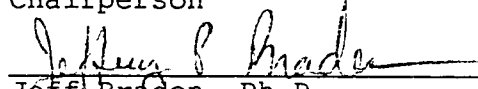
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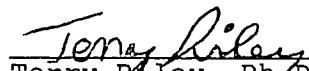
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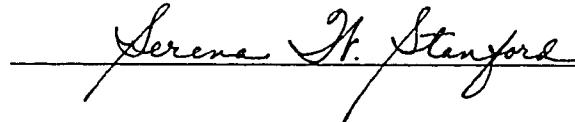


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A Comparison of Brainstorming and the Critical Evaluation
Method of Problem-Solving
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Running head: BRAINSTORMING

Footnotes

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Abstract

An actual organizational problem of a large Northern California computer company was presented to 24 of its male customer engineers. Thirteen of the subjects were asked to independently brainstorm by generating idea lists and then to develop an action plan(s) to correct the organizational problem. The other 11 subjects were asked to independently critically evaluate their generated idea list and then to develop an action plan(s) to correct the same problem. The action plan proposals were evaluated for quality and feasibility by two human resources experts familiar with the organizational problem. Three statistical tests were used to examine significant differences between the two problem-solving groups: the t test, the median test for two independent samples, and the Mann Whitney U test. Contrary to previous studies, the brainstorming group's proposals were not significantly different from the critical evaluation group's proposals. Explanations for the results are discussed.

A Comparison of Brainstorming and the Critical Evaluation
Method of Problem-Solving

Brainstorming, originated by Alex F. Osborn in the late 1940's, is a problem-solving technique for generating creative ideas by individuals and groups. Osborn was interested in stimulating the creativity of his personnel at Batten, Barton, Durstine, & Osborn, his advertising company. He decided to systematize problem-solving methods he used in his own work. This led to Osborn advising colleagues on effective problem-solving techniques. Brainstorming is thought to be enhanced when the following conditions are encouraged (Osborn, 1963):

- (1) Defer judgment: initial criticism of ideas is prohibited. Idea evaluation is done at a later time.
- (2) The wilder the idea, the better.
- (3) Elicit as many ideas as possible. More ideas yield an increased chance of more good ideas.
- (4) Build and improve upon others' ideas.

Deferring judgment is crucial to the brainstorming process because the remaining three principles stem from this

first rule. When brainstorming participants are not preoccupied with defending their ideas, then rules 2-4 can be followed because (a) ideas are easier to "tame" down than to build up, (b) ruling out criticism adds to the quality and quantity of ideas generated, and (c) censorship inhibits further creative thinking resulting from negative judgment.

Group brainstorming is practiced in many major North American corporations (e.g., FMC Corporation, Hewlett-Packard). It has not been empirically established whether brainstorming is, in fact, more effective than other problem-solving methods, such as the technique of critically evaluating ideas.

The technique of critically evaluating ideas consists of generating an idea, then immediately assessing the idea's merit. For example, a training manager must develop a new strategy to increase attendance at her company's technical writing class. The manager decides to elicit ideas from her subordinates. On the one hand, if the subordinates feel that each generated idea will be immediately critically evaluated, then the subordinate will tend to generate only those ideas that seem "safe." On the other hand, if the subordinates

feel that any idea is welcome, than there will be more ideas to choose from and the quality of ideas generated improves (Osborn, 1963). In brainstorming, quantity of ideas generated is the initial priority. Quality is evaluated later, after all possible ideas have been generated.

Brainstorming's effectiveness has been compared to other problem-solving methods during the last 30 years. Brainstorming's alleged superiority has been primarily anecdotal and based upon studies whose external validity is questionable. Previous studies often have judges without expertise in the problem area assessing the quality of ideas generated (Buyer, 1988; Diehl & Stroebe, 1987; Dunnette, Campbell, & Jaastad, 1963). The inadequate methodology is exacerbated by the failure to impose reality constraints when evaluating the ideas (Dillon, Graham, & Aidells, 1972; Firestein & McCowan, 1988; Necka, 1984; Ruback, Dabbs, & Hopper, 1984). In addition, past brainstorming problems have included irrelevant topics such as "How many other uses can you think of for a hanger?" and "What practical benefits or difficulties will arise if people had an extra thumb on each hand?" The judges rating the ideas generated from these brainstorming sessions could not use reality constraints when

differentiating between "good" ideas from "bad" ideas because there was nothing to base their ratings on.

Brainstorming is usually practiced in groups of six to eight people. However, numerous studies have compared group brainstorming to individuals brainstorming by themselves. Research strongly indicates that individual brainstorming is superior to group brainstorming. Specifically, ideas created in isolation are more feasible and are of a higher quality (Bouchard, Drauden, & Barsaloux, 1974; Graham & Dillon, 1974). Proponents of group brainstorming assert that there is no empirical evidence to support the claim of individual superiority (Lamm & Trommsdorff, 1973). This disagreement between scholars continues.

The three weaknesses of previous studies are (a) inadequate judges rating the brainstorming topics, (b) irrelevant evaluation criteria, and (c) unrealistic brainstorming topics. This study attempts to improve previous research in three areas (a) conducting a controlled experiment in which brainstorming is compared to the critical evaluation method, (b) impose specific, relevant criteria for evaluating the solutions generated by the problem-solving technique, and (c) use experts and subjects familiar with the brainstorming topic. The main hypothesis of this study is

that the quality of ideas generated by individuals engaged in brainstorming will be superior to the ideas generated by individuals using the critical evaluation method of problem-solving when the stated areas of improvement are met.

Method

Subjects

The sample included 24 male customer engineers from a large computer company in Northern California. Eight of the subjects decided not to participate in the experiment and withdrew without penalty. Subsequently, 24 subjects remained. Subjects had recently completed an employee opinion survey ("The President's Opinion Survey"), and the customer engineering group's results indicated that their job satisfaction and employee morale were lower than other organizations in the company. Subjects had no formal training in brainstorming (i.e., subjects stated that they had not had any experience in brainstorming). Subjects were volunteers from a technical training class they were attending. Subjects did not receive any compensation for their participation.

Materials

The experimenter distributed a two-page booklet to all of the subjects. The first page contained instructions and the

second page was a blank sheet of paper. Thirteen randomly selected subjects received booklets with the following brainstorming instructions on the first page, following the format of Sappington and Farrar (1982):

Please read all of the instructions carefully before proceeding. Read the scenario below. Next, jot down all of your ideas as they occur to you on the next sheet. Do not worry if your ideas are good or not. Do not evaluate the ideas as you think of them, just have fun. Make a quick note of any idea you think of. You will have 15 minutes to complete this task. Then please wait for further instructions.

Another 11 randomly selected subjects received booklets with the following critical evaluation instructions:

Please read all of the instructions carefully before proceeding. Read the scenario below. Next, jot down all of your ideas as they occur to you on the next sheet. As you write down each idea, immediately evaluate the idea very carefully and

put a plus mark (+) beside the idea if you think it is a good one and a minus sign (-) beside the idea if you think it is a bad one. Then, think of and write down the next idea. Then, please wait for further instructions.

All of the booklets contained the following scenario at the bottom of the first page:

The President's Opinion Survey was conducted throughout your company last fall. The results for the customer engineering organization indicate that job satisfaction and employee morale is lower than in other organizations in the company. Your task is to recommend to customer engineering management, strategies to improve job satisfaction and employee morale.

After 15 minutes, both groups were given a third page with the following instructions:

Look over your idea list. From this idea list, develop an action plan(s) that can improve job

satisfaction and employee morale in your organization. Write your proposal in paragraph form. You will have 20 minutes to complete this task.

Design and Procedure

The subjects were randomly assigned to one of the two groups. Both groups completed the experiment in the same room. Half of the group was given brainstorming instructions and the other half was given the critical evaluation instructions. All subjects worked independently.

Rating Criteria

Solutions were rated by two human resources experts who each had more than 10 years experience evaluating effective proposals for increasing job satisfaction and employee morale in the work place. They were unaware of the condition to which subjects were assigned. The criteria they used for evaluating feasibility of the action plan(s) were based on their professional experience. Before the actual coding of the action plans, the experts developed criteria that would distinguish an inferior final proposal from a superior proposal. The criteria were based on four factors.

1. Scope--how extensive was the proposal.

2. Specificity--was it general or specific?
3. Cost--was it cost effective?
4. Implementation Time--was it time effective?

Data Analysis

The two raters independently examined the subjects' action plan(s) and evaluated the feasibility of each proposal using a 7-point Likert scale (1 indicating inferior and 7 indicating superior). Inter-rater reliability was computed by using the Pearson product-moment correlation to assess the degree of agreement between the two raters. The two raters' scores were then averaged. These averaged scores on quality of ideas generated were the data used to compare the two groups.

Results

The Pearson product-moment correlation, which indicates inter-rater reliability, was $r = .80$. This indicates that the human resources experts' rating criteria were reliable.

To test the difference between scores in the brainstorming group and scores in the critical evaluation group a t -test was used. Table I indicates that there was no significant difference between the two groups ($t(22) = 0.94$, $p > .05$). This result suggests that the brainstorming

Table 1

Means, Standard Deviations, and t-test Results for the
Brainstorming and the Critical Evaluation Groups

Problem-Solving Method	Mean	Standard Deviation	t Score
Brainstorming	5.42	.86	
Critical Evaluation	5.00	1.54	.94*

*p > .05

group's idea quality is not superior to the critical evaluation group's idea quality.

Due to the small sample size, a median test for two independent samples and a Mann Whitney U test were used to analyze scores. Table 2 shows that there was no significant difference between the brainstorming group's score and the critical evaluation group's scores ($\chi^2(1, N = 24) = .23$, $p > .05$).

The Mann Whitney U test (see Table 3) also showed no significant differences between the groups. ($z = -.94$, $p > .05$)

Discussion

These findings clearly fail to support the proposition that brainstorming is a superior problem-solving method compared to the critical evaluation method. One explanation for this result may be, as mentioned earlier, the subjects had taken a previous survey that indicated that their employee morale and job satisfaction was low. It is interesting to note that 25% of these subjects chose to withdraw from a study intended to enhance their working climate. The subjects who chose to remain in the study may have been very motivated to increase their morale and job

Table 2

Median Test Results for the Brainstorming and the Critical
Evaluation Groups

	Brainstorming	Critical Evaluation	Total
Greater Median	6	4	10
Less Median	7	7	14
Total	13	11	

$p > .05$

Table 3

Mann Whitney U Test Results for the Brainstorming and the
Critical Evaluation Groups

Problem-Solving Method	Mean Rank	
Brainstorming	13.73	
Critical Evaluation	11.05	
U	W	Z
55.5	121.5	-.94

$p > .05$

satisfaction. Unlike previous studies that did not test realistic, personal brainstorming topics, both groups had a vested interest in writing the best possible proposal. This is demonstrated by the large mean for each problem-solving group. Both means were five or higher, indicating that overall the proposals were good based on the 7-point Likert scale used by the raters.

Another explanation for the non-significant results was the unexpectedly small sample size. If all 32 subjects had decided to participate, then the t -test, a powerful parametric test, may have obtained significant results. Due in part to the withdrawal of eight subjects, the power to reject the null was limited.

Another possible explanation exists for the results. Subjects were assured that their answers would be anonymous. However, in a business setting, employees tend to be very cautious in what they say, or in this case, what they write. Subjects may have felt inhibited to write down a "wild" idea, especially in the brainstorming group, for fear of chastisement. If the subjects felt more secure that they were truly safe against any management retribution, then perhaps their proposals would have represented their true, uncensored feelings. In turn, the brainstorming group's

proposals may have been rated higher by the human resources experts.

The results may be also due to neither method is superior to the other, i.e., quality of ideas are neither enhanced by brainstorming or the critical evaluation method of problem-solving. This implies that people who brainstorm are not benefitting any more than those who critically evaluate their ideas. Should brainstorming continue to be used for promoting creative thinking and productivity in the work place? This needs to be further investigated.

This study was unique for the following reasons: (a) the brainstorming topic was relevant to the subjects, (b) proposals were rated by experts, (c) reality constraints (i.e., relevant, specific criteria) were established for evaluating the proposals. Even though previous studies have claimed that brainstorming is a better problem-solving technique than the critical evaluation method, this conclusion is questionable. The methodology of this study sets a new standard for future brainstorming research. Scholars need to consider external validity issues when claiming brainstorming's efficacy.

Brainstorming

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REFERENCES

References

- Bouchard, T.J., Drauden, G., & Barsaloux, J. (1974). A comparison of individual, subgroup, and total group methods of problem solving. Journal of Applied Psychology, 59, 226-227.
- Buyer, L. (1988). Creative problem solving: A comparison of performance under different instructions. Journal of Creative Behavior, 22, (1), 55-61.
- Diehl, M., & Stroebe, W. (1987). Productivity loss in brainstorming groups: Towards the solution of a riddle. Journal of Personality and Social Psychology, 53, 497-509.
- Dillon, P.C., Graham, W.K., & Aidells, A.L. (1972). Brainstorming on a "hot" problem: Effects of training and practice on individual and group performance. Journal of Applied Psychology, 56, 487-490.
- Dunnette, M.D., Campbell, J., & Jaastad, K. (1963). The effect of group participation on brainstorming effectiveness for two industrial samples. Journal of Applied Psychology, 47, 30-37.
- Firestein, R.L., & McCowan, R.J. (1988). Creative problem solving and communication behavior in small groups. Creativity Research Journal, .1, 106-114.

- Graham, W.K., & Dillon, P.C. (1974). Creative supergroups: Group performance as a function of individual performance on brainstorming tasks. Journal of Social Psychology, 93, 101.
- Lamm, H., & Trommsdorff, G. (1973). Group versus individual performance on tasks requiring ideational proficiency (brainstorming): A review. European Journal of Social Psychology, 3, 380.
- Necka, E. (1984). The effectiveness of synectics and brainstorming as conditioned by the socio-emotional climate and type of task. Polish Psychological Bulletin, 15 (1), 41-50.
- Osborn, A.F. (1963) Applied Imagination. NYC: Scribner.
- Ruback, R.B., Dabbs, J.M., & Hopper, C.H. (1984). The process of brainstorming: An analysis with individual and group vocal parameters. Journal of Personality and Social Psychology, 47, 558-567.
- Sappington, A.A., & Farrar, W.E. (1982). Brainstorming vs. {sic} critical judgment in the generation of solutions which conform to certain reality constraints. Journal of Creative Behavior, 16 (1), 68-73.