BRAINSTORMING AND ITS EFFECTIVENSS TOWARDS THE PRODUCTION OF IDEAS IN THE GROUP PROCESS

by

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TABLE OF CONTENTS

LIST OF TABLES

Introduction

Brainstorming and its Effectiveness Towards the Production of Ideas in the Group Process

Brainstorming is a technique for the production of new ideas in which all ideas are expressed without regard to quality (Shaw, 1971). A considerable amount of research on the technique of brainstorming has found that group brainstorming is less productive than individual brainstorming. The now classic experiment of Taylor, Berry, and Block (1958) concluded that group participation when using brainstorming inhibits creative thinking. Individuals produce both more ideas and more unique ideas. Dunnette, Campbell, and Jaastad (1963) replicated the Taylor, Berry, and Block study a few years later and reported similar results. Several other studies (Dillon, Graham, & Aidells, 1963; Graham & Dillon, 1974; Milton, 1975; Street, 1974) reported similar results to those of Taylor, Berry, and Block study.

Many small group textbook authors, however, have accepted the technique without questioning its appropriateness to small group communication. Two of brainstorming's strongest supporters are Ernest G. Bormann and Marvin E. Shaw. Bormann (1969) claims that Osborn has discovered the "facilitating effect of agreement on the social climate of a group. A brainstorming group can develop a highly permissive and pleasant social climate simply by arbitrarily ruling out disagreement" (pp. 190-191). In Shaw's book Group Dynamic: The Social Psychology of Small Group Behavior (1971), brainstorming is discussed in terms of the research that has been done on the technique. Shaw (1971) refutes all the above

studies, stating that they indicate nothing about the effectiveness of brainstorming. Bormann and Shaw agree that when using the technique of brainstorming groups produce more ideas than individuals. Since there is a disagreement among the researchers and textbook authors an analysis of both the process and research seems appropriate.

The purpose of this report is to assess the research on brainstorming to determine the techniques effectiveness on various group process variables. Most studies employed variables that measured the extent to which brainstorming facilitated group processes. The term "facilitate" took on several meanings in the research literature. It was defined as the "number of ideas produced," "number of good solutions," "the quality of ideas," and "number of different ideas." Brainstorming's effectiveness with respect to these variables will be examined using a statistic that measures effect size.

Effect size is the ratio of the difference between the means to the standard deviation (Cohen, 1977). It is a specific non-zero value that assesses the degree to which the null hypothesis is false (Cohen, 1977). The larger the effect size the greater the likelihood that the phenomenon in question is present in the specific population. The studies examined in this report often used treatment (Brainstorming) versus control (Non-Brainstorming) group designs. The effect size will then provide us with a measure of the impact of brainstorming on the aforementioned group process variables.

Definition

Osborn's (1963) four rules regulate brainstorming methods:

1. Criticism is ruled out. Adverse judgment of ideas must be withheld until later.

2. "Free-Wheeling" is welcomed. The wilder the idea, the better it is to tame down than to think up.

3. Quantity is desired. The greater the number of ideas the more likelihood of a winner.

4. Combination and improvement are sought. In addition to comtributing ideas of their own, participants should suggest how ideas of their own can be turned into better ideas; or how two or more ideas can be joined into still another idea.

In addition to the four rules Osborn sets up other aspects of brainstorming. The group must consist of a leader who serves as a moderator for the group. The ideal size for a brainstorming group is between five and ten. This group must have core members who have a history of brainstorming. The sessions should run one hour. Several follow-up sessions should be initiated to analyze, modify, combine and adapt the ideas produced.

Brainstorming creates a particular situation within the group. Osborn devised brainstorming to create a free and uninhibited atmosphere which he thought would increase the creativity of group members. In this situation the individual is encouraged to feel free to say whatever he or she wants with no fear of disapproval (Coon, 1957, p. 117). Brainstorming participants are stimulated by the individuals around them. This stimulation with all the "new," "different," and "crazy" ideas allow the group participants to put his or her full attention on the problem. This situation is thought to reduce pressure to conform and to substitute pressure to be a nonconformist (Hare, 1982). Thus, brainstorming is meant to be used as a supplement to creative thinking.

Background

Brainstorming was introduced by Alex Osborn in 1953 (Brainstorming,

1968). At the time Osborn was an executive vice-president of Butten, Baston, Durstine, and Osborn (BBDO), one of the largest advertising agencies in the world. Osborn extended this procedure to his clients. Brainstorming sessions are a regular policy at BBDO, and in its first year of use it was estimated that over 2,000 worthwhile ideas were generated (Clark, 1958).

Since the 50's brainstorming has been discussed in most college-level, small-group textbooks. In 1959 Thibaut and Kelly published Social Psychology of Groups which discussed Osborn's ideas and his findings. Brainstorming has been discussed in textbooks by Ernest G. Bormann (1969), Paul Hare (1976), and Marvin E. Shaw (1971). These textbooks and other small-group textbooks treat brainstorming in one of three ways. First, a review of the research concerning brainstorming is given. In the second section a discussion of how to use the brainstorming procedure is given. The third section is a review of the literature and a discussion of the brainstorming procedure. These textbooks devote some space to brainstorming, either as a specific discussion technique or an adjunct to more formal problems. Textbook writers often uncritically accept Osborn's claims despite whatever claims exist to the contrary.

Brainstorming is not only taught in small group classes, but is also used as a teaching technique to develop creativity and spontaneity among speech therapist and their clients (Wilson, 1959). In addition, the 1968 edition of Today's Education reports that using brainstorming in the classroom can teach students to respect and build on their own creative capacity and that of others and to adopt the experimental frame of mind essential to effective problem-solving. Educational institutes also use the technique. When faced with the problem of increased enrollment,

Michigan State University realized that the problem would demand a creative solution (Posz, 1959). The university decided to try brainstorming.

Other institutes use brainstorming extensively. The U. S. Army set-up a two-week course in brainstorming within its officer candidate school. Social workers have employed this technique. Brainstorming has also been employed by such business firms as: General Electric, International Business Machines, Sears, Boeing, U. S. Steel, Dupont, Eastman Kodak, Kraft Foods, and Campbell Soups (Clark, 1958). Brainstorming has been widely used in sales, production, and management. Several firms have reported increased profits as a result of ideas generated at brainstorming sessions (Clark, 1958).

At the height of its popularity, the claims for brainstorming were partisan, impassioned, exaggerated, and rarely documented (Jablin & Seibold, 1978). In the face of these claims, investigators undertook a systematic study of brainstorming. A majority of the studies were completed during the 70's. Since the late 1950's to the present more than thirty experimental studies on the effectiveness of brainstorming have been conducted.

Results

Twenty-three studies were obtained for this report. These studies will be examined in the following areas: (1) experimental procedures; (2) analysis of statistical data. An examination of the studies in which no effect size could be computed will be discussed under the analysis of statistical data. These examinations will aid in determining whether brainstorming is effective on various group process variables.

Experimental Procedures

Half of the studies employed as their dependent variable "the production of ideas" (See Appendix A). The "production of ideas" was also termed "group performance," "creativity," or "the number of ideas generated." Such research examined what effect brainstorming versus no brainstorming had on the production of ideas. Other researchers, such as Fredric Jablin, were not concerned with the production of ideas. His research analyzed how brainstorming affects an individual's preception of status within the group (Jablin & Sorenson, 1978; Jablin, Sorenson, & Seibold, 1978), satisfaction with own performance and with group performance (Jablin, Sorenson, & Seibold, 1978; Jablin & Sussman, 1976), and communication apprehension (Jablin, Seibold, & Sorenson, 1977; Jablin & Sorenson, 1978; Jablin & Sussman, 1978). Even though these few studies are not totally concerned with the production of ideas, they are concerned with what type of individual will produce the most ideas in the brainstorming situation.

Brainstorming was employed as the sole independent variable by most of the studies. A few other studies used another independent variable. This variable was the type of group: "real" or "normal" (Jablin & Seibold, 1978, p. 337). Real groups are interacting groups of four or five members while nominal groups are a group of individuals who work alone on a problem but whose performance is scored as though the members had worked together (Jablin & Seibold, 1978).

The randomized control-group post-test-only design was employed by most of the studies. Subjects are assigned at random to the experimental and control group (Isaac & Michael, 1975). Jablin used the factorial design. This design permits research studies where more than one factor

is free to vary at a time (Isaac & Michael, 1975). Several hypotheses can be tested simultaneously and several questions can be answered by one experiment. Jablin used this design to test the factors of status, satisfaction, and communication apprehension. There were no control groups in his studies as all of the subjects brainstormed in groups.

Sample size for most of the studies had fifty or more subjects with a few studies having two hundred or more subjects (See Appendix A). The most common size was ninety-six. The number of groups that were used averaged around twenty different groups. The number of groups appears adequate but the size of each group might be considered small. Each group contained only four members. The sample was obtained mainly from undergraduate students in their junior or senior year. Only two of the studies used subjects not in an academic situation. These subjects were obtained from the business community where brainstorming is frequently used.

Analysis of Statistical Data

The majority of studies used an ANOVA or T-Test to analyze their data, while the remaining studies used percentages or frequency distributions. In the latter case no effect size statistic can be calculated. Consequently, not all of the studies can be evaluated using the effect size statistic.

Interpreting effect sizes can be accomplished in three ways. The direction of the effect size is meaningful itself. A zero effect size is categorically clear; positive and negative sizes are also meaningful in and of themselves. Second, an effect size can be comprehended by comparing it to other statistical representations. Glass, McGaw, and Smith (1981) often compare them to percentiles found under the normal curve. For instance, an effect size of .86 means that average "treatment"

subjects exceed 80% of the untreated controls on some dependent variable. On the other hand, Hunter, Schmidt, and Jackson (1982) transform the effect size into a correlation. This describes the amount of relationship between the independent and dependent variable.

Finally, effect sizes can be referred to comparable research in which the effect size is well understood. Under this circumstance one can make specific comments about the magnitude of the effect size. Unfortunately, communication research is not yet at a point in which we can refer to well-defined effect sizes.

Not all of the studies could be evaluated using an effect size statistic. These studies will be examined in another manner. These studies reached conclusions about brainstorming that need to be discussed.

Studies in which no effect size could be computed.

Seven of the studies obtained for this report summarized their data using percentages or frequency distributions. No effect size can be calculated from these. We must examine the studies in another manner. We shall examine the conclusions that these studies reached and the basis for these conclusions.

Dillon, Graham, and Aidells (1963) reported the mean scores but failed to include the ANOVA table in their report. They studied the effects of training and practice on individual versus group brainstorming. They concluded that individuals brainstorming alone generated more ideas than individuals brainstorming in groups. The report stated that across all conditions there is significant main effect because of the difference between the mean scores of individual brainstorming and group brainstorming. Their conclusions is based on this finding.

Graham and Dillon (1974) reported only the number of ideas generated in a twenty minute period. This study investigated the performance of individual brainstorming and the relative productivity of groups. The results show that individual brainstorming produces more ideas than group brainstorming. The number of ideas generated, Individual-68 and Groups-38, in a twenty minute period by the subjects is the evidence that they are using to support their conclusion.

Johnson and Torcivia (1959) reported correctness and certainty scores which were represented in percentages. This study examined group versus individual performance. It was concluded that groups did not improve their performance. This conclusion was reached by observing the difference between the two administrations of the problem. It is also based on the information that the percentages are significantly less than 100%.

G. A. Milton (1975) reported the median number of solutions for each condition. His study examined problem-solving productivity of four-man groups compared with that of equal numbers of individuals working alone. Milton reached his conclusions by comparing the median number of solutions produced by the nominal and real groups.

Nelson, Petelle, and Monroe (1974) reported no statistical data at all. The purpose of their study was to supplement the brainstorming technique with a list of topical cues designed to stimulate idea generation. The results of this study indicate that the use of a topical system to aid the creative process is a viable extension of the brainstorming approach. The results that they are referring to are the results of the Freidman procedure (Nelson et al, 1974) for the two-way analysis of variance by ranks. They stated that the results were significant

and accounted for 34.03% of the total variance. Nelson, Petelle, and Monroe are basing their conclusion on the result of the Freidman procedure, even though they do not report those results in their article.

Warren Street (1974) reported the mean number of responses to creativity problems. This study compared the productivity of individuals with interacting groups. Interacting groups versus individuals were found to be inferior to individuals in the production of answers to problems. Street based his conclusion on the mean scores. The mean productivities in the individual groups are far superior to productivity in the interacting groups.

Taylor, Berry, and Block (1958) were the first to conclude that individuals are superior in performance over group participation. This now classic experiment reported all statistical data except for one factor. They did not report the "mean score within" which is needed to calculate an effect size. They examined the performance of nominal and real groups in order to answer the question: "Does group participation when using brainstorming facilitate or inhibit creative thinking?" (Taylor, Berry, & Block, 1958, p. 23). The results of this experiment can be generally sumarized: group participation when using brainstorming inhibits creative thinking. This generalized conclusion was based on the markedly inferior performance of the real groups in terms of number of ideas produced and number of unique ideas produced.

Even though these studies did not report statistical data that could be calculated into an effect size, they all reached similar conclusions. These conclusions were based on the number of ideas that were generated by individuals. Individuals generated more ideas than groups that brainstormed. This set of studies lead us to conclude that brainstorming

is not as effective towards the production of ideas in the process as it is with individuals.

Studies having treatment versus control designs.

Twenty individual studies used the treatment-versus-control design so an effect size could be calculated for these studies. The effect size was transformed into a correlation in order to interpret the amount of relationship between the independent and dependent variables. An r^2 is the proportion of the total variation in the dependent variable explained by the independent variable (Blalock, 1972). Nine of the twenty studies have correlations falling in the range of -.10 to +.10 (See Table 1). The r^2 means that brainstorming is a factor in only 1% of the ideas generated within a group. Consequently, we can assume that this is a very small effect size.

Ten of the twenty studies have a negative effect size which means that the non-brainstorming groups did better than the brainstorming groups in generating ideas (See Table 1). With regard to the effect sizes, the non-brainstorming groups did significantly better. The Bouchard studies (1972a, 1972b) are an excellent example of this condition. The correlations of his studies ranged from -.08 to -.71. The Bouchard study (1972a) of trained/untrained showed the greatest significance. The treatment groups were trained in the technique of brainstorming while the control group received no training in the technique of brainstorming. The trained groups performance was inferior as the untrained groups generated significantly more ideas. The r^2 for this study is .01 which means that brainstorming affected only 1% of the ideas generated within the group. Non-treated groups do better than treated groups. Giving

Table 1

Treatment vs. Control Effect Sizes

Study	Comparison	Dependent	X_1	X_2	SD	ES	r
Bouchard (1972)	Brainstorming/ Nonbrainstorming	#different ideas generated					
	Motivation		210.0	190.4	48	.4	.21
	Training		196.0	203.4	48.55	-.16	-.08
	Procedure		175.7	228.4	40.95	-1.28*	-.56
Bouchard (1972)	Brainstorming/ Nonbrainstorming	#different ideas generated					
	Session 1		122.6	195.7	42.55	-1.7	-.71**
	Session 2		152.9	175.8	53.95	-.42	-.23**
	Session 3		174.5	214.2	55.5	-.71	-.37**
Bouchard Barasaloux Drauden (1974)	Brainstorming/ Nonbrainstorming	#different ideas	6.3	15.5	24.2	-.38*	-.19
Bouchard Hare (1970)	Brainstorming/ Nonbrainstorming	#different ideas	1.3	1.3	13.3	0*	.0
Buchanan Lindgren (1973)	Brainstorming/ Nonbrainstorming	# of responses					
	School 1		12.2	11.7	3.1	.16*	.08**
	School 2		15.1	9.3	2.8	2.0*	.72**
	School 3		13.5	9.8	3.5	1.0*	.42**

Table 1 (Continued)

Study	Comparison	Dependent	X_1	X2	SD	ES	r
Cohen Whitymre Funk (1960)	Brainstorming/ Nonbrainstorming	# of responses					
	Tourist Problem		1.7	1.3	7.2	.05*	.02
	Thumb Problem		1.2	1.1	6	.02*	.01
	Discharge Problem		1.6	1.5	8.4	.01*	.005
Collaros Anderson (1969)	Brainstorming/ Nonbrainstorming	# of responses	13.46	16.06	3.17	-.66	-.33
Dunnette Campbell Jaastad (1963)	Brainstorming/ Nonbrainstorming	# ideas generated					
	Research		2.29	2.92	7.6	-.082*	-.04
	Advertising		2	2.94	5.6	-.16	-.43
Meadow Parnes Reese (1959)	Brainstorming/ Nonbrainstorming	# of responses	.4	.2	2.1	.09	.046
Parnes Meadow (1959)	Brainstorming/ Nonbrainstorming	# of responses	.16	.09	1.7	.04	.02
Weisskopf-Joelson Eliseo (1961)	Brainstorming/ Nonbrainstorming	# of responses	42.41	48.78	28.8	-.22	-.11

*Real/Nominal Groups
**Unequal group size accounted for

further support to this notion are the seven studies that have small effect sizes. These sizes are so small that they could be considered as zero. A zero effect size means that dependent variable is not affected by the independent variable. Even though the effect sizes are near zero, their r^2 is .01. Again only 1% of the ideas generated within the group were due to brainstorming. In view of all this information, we can conclude that non-brainstorming groups sometimes do better than brainstorming groups in the generation of ideas.

Three of the twenty studies (See Table 1) have a large effect size which means that brainstorming groups did better than non-brainstorming groups in the generation of ideas. These large effect sizes can easily be explained. The Bouchard study (1972) has a r^2 of .04 which means the 4% of the ideas generated within the group were due to brainstorming. In this study Bouchard motivated the brainstorming groups by giving them a reward of fifteen dollars. The non-brainstorming groups received no reward. The positive reward of money motivated the brainstorming groups to generate more ideas. The Buchanan and Lindgren study (1973) has a collective r^2 of .25. 25% of the ideas generated within the group were affected by brainstorming. This study employed children in the fourth grade. The subjects were tested in a familiar setting--the classroom. These two points can explain the large effect sizes: the subjects were tested in a familiar setting and felt less inhibited in their performance. Children in a brainstorming situation feel less inhibited than adults. The inhibition of adults can be seen in the negative effect sizes of several studies (Bouchard, 1972; Bouchard & Hare, 1970; Meadow, Parnes, & Reese, 1959; Parnes & Meadow, 1959). If an individual within a group is given a positive reward or is a child, he or she will probably generate

Table 2

Factorial Design Effect Sizes*

Study	Comparison	Dependent	X_1	X_2	SD	ES	r
Jablin Seibold Sorenson (1977)	HA/History-AdHoc	# of ideas generated	53.75	48.20	14.51	.38	.19**
	LA-HA/History-Nominal		73.20	55.43	19.94	.89	.42**
	LA/AdHoc-Nominal		69.50	62.33	20.05	.35	.18**
Jablin Sorenson (1978)	LA-HA/Nominal	Status/Satisfaction	60.50	55	9.63	.57	.28
	(HA-LA/Nominal)-(HA/Interacting)		57.50	36.40	11.48	1.8	.70**
	(LA-Interacting)-(HA-LA/Interacting)		46.60	47.25	14.27	-.07	-.037**
Jablin Sorenson Seibold (1978)	Low Apprehensive/High Apprehensive	Status/Satisfaction					
	Perceived Status Differential		12.89	9.33	7.46	.47	.235
	Individual Satisfaction		3.11	3.19	1.43	-.05	-.025
	Group Satisfaction		2.78	2.78	1.42	0	.0
Jablin Sussman (1976)	Low Producers/High Producers	Status Satisfaction Communication Apprehension					
	Perceived Status Differential		15.20	12.17	8.19	.36	.18
	Individual Satisfaction		3.84	3.43	1.56	.26	.13
	Group Satisfaction		3.08	3.43	1.29	-.27	-.13
	Perceived Personal Status		5.78	4.28	2.08	.72	.34
	Communication Apprehension		75.12	66.49	14.85	.58	.28

Table 2 (Continued)

Study	Comparison	Dependent	X_1	X_2	SD	ES	r
Jablin Sussman (1978)	Status/LA-HA	# ideas generated	21.19	4.44	4.20	3.9	.90

*All Brainstorming
**Unequal group size accounted for

more ideas using the technique of brainstorming.

Altogether, seventeen of the twenty studies had either a negative or a small effect size. Examining all this evidence we can conclude that brainstorming does not have a strong impact on the production of ideas in the group process.

Studies having a factorial design.

Fredric Jablin extended the research on the technique of brainstorming. He did not examine the effect of brainstorming on the generation of ideas but examined individual differences with respect to brainstorming. Jablin examined status within the group, satisfaction with own performance, satisfaction with group performance, high communication apprehension, and low communication apprehension (See Table 2).

In his research satisfaction was found not to have a strong effect on brainstorming. The effect sizes were small in satisfaction and perceived status differential. Status and communication apprehension were found to have an effect on how people perform in brainstorming groups. High status individuals and low apprehensive individuals improve brainstorming. In this situation 81% of the ideas generated within the group were effected by brainstorming. High apprehensives and low status individuals do worse in brainstorming. Several studies have found that communication apprehension has an effect on brainstorming (Hare, 1976). As might be expected high apprehensives do less brainstorming, due to their fear of communicating with others. Low status individuals apparently feel apprehension when communicating with high status individuals. Consequently, low status individuals tend to be cautious in front of high status individuals (Hare, 1976). Apparently any kind of an apprehension has an effect on an individual's performance.

Jablin discovered nothing new but just reinforced what we know from previous research. If an individual is a high apprehensive or a low status individual, he or she will not perform well in a brainstorming group. If an individual is a low apprehensive or a high status individual, he or she will do better in a brainstorming group.

Conclusion

After examining the results of the various studies we can conclude that brainstorming has a questionable impact on group functioning. Some studies found that non-brainstorming groups produced more and better quality ideas than groups that brainstormed. Other studies found that brainstorming has little effect on the production of ideas in groups.

Several points should be made about the studies on brainstorming. Flaws in the experimental procedure could have effected the results of these studies. The number of groups is probably adequate, but the size of the groups needs to be increased from four to seven or eight members. Increasing the group size will place us nearer to the way brainstorming is used outside the experimental situation. The subjects of the studies should not always be students, but should include individuals from the business community.

A reliability index informing us on how reliable the measurement of the dependent variable is should be reported for every study (See Appendix A). If the reliability score is low, an explanation should be given as to why it is low. All essential data should be reported when using any form of analysis. This will enable the experimenter to draw accurate conclusions concerning his findings.

Brainstorming has only a small impact on group functioning because

it is a prescriptive approach to problem-solving. The prescriptive approach is based on an assumed "ideal" process which implies that there exists a "right" or at least a "best" way to make decisions (Fisher, 1980, p. 130). The prescriptive approach uses an agenda to illustrate how groups should make decisions. This agenda leads the group members to conform to an ideal process. The use of Osborn's four rules of brainstorming provides the agenda and makes brainstorming a prescriptive approach to group decision making. The prescriptive approach also rests on two assumptions. First, it is assumed all members are consistently rational (Fisher, 1980). Second, an attempt is made to improve the quality of the group's decision making outcomes (Fisher, 1980). The prescriptive approach is not a free and uninhibited process for group decision making and does not lead to better decision making. In that respect, brainstorming does not have an impact toward the production of ideas in the group process.

Brainstorming is not the only strategy in the prescriptive approach that is not as effective as previously thought. A formal process such as John Dewey's Reflective Thinking Sequence has been employed to facilitate group decision making. Research has shown, however, that the Reflective Thinking Sequence is not as effective towards the production of ideas as previously thought (Nelson, Petelle, & Monroe, 1974). Brainstorming is also not as strong as previously thought. Brainstorming is not effective towards the production of ideas. We can assume that brainstorming and Dewey's Reflective Thinking Sequence are both wrong in their approach to problem-solving.

There are reasons strategies such as brainstorming may be ineffective. Many social psychologists have taken a rather pessimistic view of the

role of group process, seeing it as something that for most part impairs group task effectiveness (Hackman & Morris, 1975, p. 49). Organizational psychologists assume that members of many task groups are inhibited from exchanging ideas and information and from working in a concentrated fashion to complete the task (Hackman & Morris, 1975). A number of suggestions have been offered to explain what may affect the production of ideas in a group. Individuals fear social chastisement by other participants for offering different ideas, and group members may censor their contributions, regardless of how much the experimenter encourages them to report every answer that comes to mind (Jablin & Seibold, 1978). Later contributions within the group begin to closely resemble earlier ones, and a motivational pressure towards conformity develops within the group since interpersonal agreement is psychologically more comfortable than disagreement (Jablin & Seibold, 1978).

Another possible explanation is that individual members perceive the group norms to be one of noninvolvement (Street, 1974). Each person waits for someone else to take the lead in producing ideas and the result is low productivity for the group. Regardless of how much the group members are encouraged to participate, some members censor their contributions because of their fear of social disapproval. This can cause group members to stay with safe ideas.

The overall conclusion of this report is that brainstorming has only a small impact on the production of ideas in the group process. A final explanation as to why the research does not find a strong impact is because the research has not conducted brainstorming sessions which follow Osborn's directives. Groups have not consisted of a leader. The leader serves to facilitate the production of ideas by adding categories

or questions. There were no core groups who had a history of brainstorming. These groups initiate the process. Typical brainstorming experiments were conducted for only ten or fifteen minutes while Osborn recommends one hour. No follow-up sessions were initiated in the studies. Brainstorming as originated by Osborn has not been accurately tested. Further research on the technique of brainstorming should be performed to more accurately test Osborn's conclusions.

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APPENDIX A

Experimental Procedure

VARIABLES	Bouchard	Bouchard
Dependent	Group Performance (Ideas rated on Bouchards 5 point scale)	# different ideas generated (Counted statements)
Independent	Motivation/No Motivation Training/Untrained Group/Individual	Synetics (# of ideas generated) Brainstorming (# of ideas generated)
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	48	44
# of Groups	12-4 Men	11-4 Men
Sample	Male students from Intro. Psychology course.	Male students from Intro. Psychology course.
Statistics	2x2x2 ANOVA	2x2 ANOVA
Reliability	-	-

VARIABLES	Bouchard, Barasaloux & Drauden	Bouchard and Hare
Dependent	# of different ideas generated (Counted statements)	# of different ideas generated (Counted statements)
Independent	Real/Nominal (# of nonoverlapping ideas)	Group Size (Counted statements that stated specific benefit of difficulty)
Ex. Design	Randomized control-grou posttest	Randomized control-group posttest
Sample Size	44	168
# of Groups	4-4 Person 4-7 Person	8-5, 7, 9 Men
Sample	Male & Female students of Intro. Psychology course.	Male students from Intro. Psychology course.
Statistics	2x2x2x2 ANOVA	3x2x2 ANOVA
Reliability	-	-

VARIABLES	Buchanan and Lindgren	Cohen, Whitmyre & Funk
Dependent	Creativity (# of responses during individual phase, rated on 7 point scale)	Creative Thinking (Taylors 5 point scale)
Independent	Brainstorming/Nonbrainstorming (# of responses)	Cohesion/Noncohesive (Preferred working with) Training/Untrained
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	122	96
# of Groups	6-2 from each school	12-8 Person
Sample	Fourth Graders	Hospital Administrators & Nurses
Statistics	Stepwise Multiple Regression	2x3 ANOVA
Reliability	-	-

VARIABLES	Collaros and Anderson	Dillon, Graham & Aidells
Dependent	Creativity (# of responses)	# ideas generated (Rules of Bouchard)
Independent	Expert/Nonexpert (Postmeeting questionaire on individuals feelings of the group)	Training/Untrained (# of different ideas generated
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	240	96
# of Groups	60-4 Men	24-4 Person
Sample	Male students in undergraduate Intro. to Psychology course.	Male & female students at University of Berkley involved in Reconstitution Activities.
Statistics	3x4 ANOVA	2x2x2 ANOVA
Reliability	-	-

VARIABLES	Dunette, Compbell & Jaastad	Graham and Dillon
Dependent	# of ideas generated (Counted statements)	# of different ideas generated (Bouchard's Comprehensive rules)
Independent	Group/Individual (Comparison of ideas rated on Taylor's Quality Scale)	Individual Performance (Tested on individual brainstorming tasks)
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	96	80
# of Groups	24-4 Person	20-4 Person
Sample	Research and Advertising personal of Minnesota Mining and Manufacturing.	Upper division Psychology students at University of California, Berkley.
Statistics	2x2x2 ANOVA	T-Test
Reliability	.66	-

VARIABLES	Jablin, Seibold & Sorenson	Jablin and Sorenson
Dependent	# of ideas produced (Coded & catagorized responses)	Status (Perceived Status Differential Scale) Satisfaction (4 item 7 point Likert Scale)
Independent	Low/High Communication Apprehension (PRCA) Type of Group (Counted responses)	High/Low Communication Apprehension (PRCA) Type of Group (Counted responses)
Ex. Design	Factorial Design	Factorial Design
Sample Size	124	104
# of Groups	31-4 Person	26-4 Person
Sample	Male and female students in undergraduate communication course.	Undergraduate students in communication course.
Statistics	Newman-Keuls Multiple Comparison Test	2x3 ANOVA
Reliability	-	-

VARIABLES	Jablin, Sorenson & Seibold	Jablin and Sussman
Dependent	Status (Perceived Status Differential Scale) Satisfaction (4 item 7 point Likert Scale)	Status (Perceived Status Differential Scale) Communication Apprehension (PRCA) Satisfaction (4 item 7 point Likert Scale)
Independent	High/Low Communication Apprehension (PRCA)	Low Producer/High Producer (Counted and coded responses)
Ex. Design	Factorial Design	Factorial Design
Sample Size	72	96
# of Groups	18-4 Person	24-4 Person
Sample	Undergraduates in communication course.	Undergraduates in Intro. Communication course at Purdue University.
Statistics	T-Test	T-Test
Reliability	-	-

VARAIBLES	Jablin and Sussman	Johnson and Torcivia
Dependent	# ideas generated (Responses counted & Coded)	Responses given (Solved mathematical problem)
Independent	Status Low/High (Perceived Status Differential Scale) Communication Apprehension (PRCA)	Performance (Solved mathematical problem)
Ex. Design	Factorial Design	Randomized control-group posttest
Sample Size	96	263
# of Groups	24-4 Person	6 Treatment Groups
Sample	Undergraduates in Intro. communication course.	Undergraduate students in Intro. and Social Psychology courses at Loyola University.
Statistics	Step-wise Multiple Discriminant Analysis	Chi-Square
Reliability	-	-

VARIABLES	Meadow, Parnes & Reese	Milton
Dependent	Creativity (Coded & rated on a 3 point scale)	Enthusiasm (Questionaire designed to measure enthusiasm)
Independent	Brainstorming Instructions/No Instructions (Counted responses)	Type of Group (Taped decision reached and discussion of decision)
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	32	48
# of Groups	4-8 Person	12-4 Men
Sample	College students from Creative Problem Solving course.	Undergraduate males enrolled in Intro. Psychology course.
Statistics	2x2 ANOVA	2 Tailed Mann-Whitney U Test
Reliability	-	-

VARIABLES	Nelson, Petelle & Monroe	Parnes and Meadow
Dependent	# qualitative and quantitative responses (Responses evaluated according to criteria)	Creativity (Responses coded and judged)
Independent	Topical System (Comparison of groups)	Training/Untrained (# of responses)
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	80	52
# of Groups	16-5 Person	4-13 Person
Sample	Students in Business and Industrial communication courses.	University of Buffalo undergraduates.
Statistics	2x2 ANOVA	Lindquists Type V Analysis of Variance
Reliability	-	-

VARIABLES	Street	Taylor, Berry & Block
Dependent	Group productivity (# of nonoverlapping ideas)	Creativity (5 step rating scale to measure feasibility, effectiveness, and generality)
Independent	Type of Group (# of responses)	Real/Nominal Groups (# of responses)
Ex. Design	Randomized control-group posttest	Randomized control-group posttest
Sample Size	108	96
# of Groups	36-3 Person	24-4 Men
Sample	Undergraduate students in Psychology courses.	Yale junior and seniors enrolled in Psychology of Personnel Administration.
Statistics	3x6 ANOVA	2x3 ANOVA
Reliability	-	-

VARIABLES	Weiskopf-Joelson and Eliseo
Dependent	# of responses (Evaluated by 150 judges on a 5 point scale)
Independent	Brainstorming instructions/No instructions (# of responses)
Ex. Design	Randomized control-group posttest
Sample Size	42
# of Groups	6-7 Person
Sample	Undergraduates at Purdue University
Statistics	T-Test
Reliability	.72 (Person R)

BRAINSTORMING AND ITS EFFECTIVENESS TOWARDS THE PRODUCTION OF IDEAS IN THE GROUP PROCESS

by

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Abstract

The purpose of this report is to assess the research on brainstorming to determine brainstorming's effectiveness on various group process variables. Most of the studies employed variables that measured the extent to which brainstorming facilitated group processes. The term "facilitate" took on several meanings in the research literature. It was defined as the "number of ideas produced," "number of good solutions," "the quality of ideas," and "number of different ideas." Brainstorming's effectiveness with respect to these variables will be examined using a statistic that measures effect size.

The studies were catagorized and analyzed in three areas: (1) Studies in which no effect size could be computed: (2) Studies having a treatment versus control design; (3) Studies having a factorial design. After examining the results of the various studies we can conclude that brainstorming has a questionable impact on group functioning. Further research ought to be done as few studies have actually conducted brainstorming sessions which follow Alex Osborn's directives.