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Group productivity and how it is affected by an imposed group structure

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Group Productivity and How It Is Affected by an Imposed Group Structure

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In partial fulfillment

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Master of Arts

in Psychology

By

Vicki Fenwick

Marshall University

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as meeting the research requirement for the Master's degree.

Advisor Christopher W. LeHew
Dept. of Psychology

Committee Christopher W. LeHew
Chairman

Steven P. Mewaldt
Dept. of Psychology

Helen E. Fisher
Dept. of Psychology

Dean Leonard J. Deutsch

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Abstract

The following study examined the ability of the stepladder technique to produce a high number of quality solutions using an applied industrial brainstorming task. Subjects were divided into three conditions; the alone group, the unstructured group, and the stepladder technique group. Each group then performed a task which required participants to provide solutions for an industrial brainstorming task. The quality and the quantity of the solutions were measured for each group. Two analysis of variance (ANOVA) procedures were conducted but revealed no significant differences for either quantity or quality. Therefore, the stepladder technique showed no prominent advantages in this particular task.

Group Productivity and How It Is Affected by Group Structure

It has been a popular trend in many different organizations to emphasize working in groups or teams. "Two heads are better than one" and "let's put our heads together," are a few common metaphors that represent the idea of two or more people working together collectively. In the classroom, sporting activities, and the work force, groups are used in a variety of ways. Research in the area of group performance has become more popular in recent years due to the increasing use of groups, such as self-managing work teams and work groups in organizations. It has been estimated that one in five United States employers is now implementing self-managing work teams with this trend constantly increasing (Tang & Crofford, 1995-1996). However, Maier (1967) points out that group problem solving has both advantages and disadvantages over individual problem solving. One of the most common reasons for using a group and the most obvious advantage is a greater sum total of information and knowledge. A collective group should provide more information and knowledge than any one member. Also, there should be a greater variety of approaches, a high acceptance of decision due to participation in problem solving, and better comprehension of the decision. However, there are some disadvantages associated with group problem solving. Social pressures to conform to an idea or decision, individual domination and influence, and social loafing are among these disadvantages.

Research in the area of group tasks shows that social loafing (i.e., the tendency for people working in groups collectively to produce less than individuals working alone) is present in many group processes.

Early Findings that Lead to the Studying of the Social Loafing Effect

The area of group work was researched as early as 1898. Triplett's study (Triplett, 1898; as cited in Sanna, 1992) showed that children wound more fishing line when working side-by-side with others than when working on this task alone. On the other hand, Kravitz and Martin (1986; as cited in Pratarelli & McIntyre, 1994) discuss the Ringelmann effect that was found by using a rope-pulling task to investigate efficient work methods. They noted that the average amount of force exerted by an individual decreased according to the size of the group in which he worked. When working alone, the individual would average 85.3 kg of force per pull; when working in groups of seven, the average was 65 kg; and when working in groups of 14, the average was 61.4kg. Early studies such as these have sparked an interest in the field of group work, especially with an emphasis on social loafing. The studies presented here will look at different aspects of the social loafing effect, ranging from ways to alleviate the effect to other phenomena that may encourage such loafing.

Social Loafing in Physical Activity

Some research has looked at the social loafing effect by focusing on physical activity. Williams, Harkins, and Latane (1981) found that people

exerted less effort when cheering and shouting in groups than when alone. This effect was eliminated when participants believed that their individual output was identifiable.

Everett, Smith, and Williams (1992) hypothesized that (1) identifiability would reduce social loafing effects among relay swimmers and (2) that there would be a negative correlation between group cohesion and social loafing. Using 16 male and 14 female members of an NCAA Division I swimming team, Everett et al. (1992) created two teams in the high identifiability condition and two teams in the low identifiability condition for each gender. The athletes were to compete in two different swimming events, an individual 100 meter swim against another individual and a 4 x 100 meter relay event. In both conditions, their times would be announced immediately after their individual performances. In the high identifiability condition, the individuals' times would be announced after each person's leg of the relay. In the low identifiability condition, the individuals were told that their individual leg times would not be announced. The results revealed that the identifiability factor had influenced the females as predicted, but the males' scores were opposite of the prediction. The Group Environment Questionnaire was used to test the group cohesion hypothesis. The results supported the hypothesis by revealing high cohesion scores on the groups that were not affected by social loafing. Everett et al. (1992) suggested that the study may have some limitations due to the small number of athletes available for such a study.

Further research would be pertinent in order to make any generalizations about this study, especially since the cohesion and social loafing effect was different between genders.

Miles and Greenberg (1993) also performed a study using swimming to test the effects of social loafing. They hypothesized that (1) subjects would swim more slowly in groups of four than when swimming alone and (2) that threats of punishment would alleviate the social loafing effect. Eighty-one males and 39 females who were members of area high school swim teams, were randomly assigned to either the individual condition or the group condition. Both groups were given target swimming times to meet that were set in a pilot test and a threat of punishment laps to swim if they did not meet this target time. There were three levels in the punishment condition; severe threat (eight laps), moderate threat (four laps), and no threat. Statistical analysis of lap times provided support for the first hypothesis that members of a group would swim more slowly than the individuals in the absence of threats of punishment. Individuals alone and individuals in groups in the moderate punishment condition swam equally well providing support for the second hypothesis. However, in the severe punishment condition, the individuals swam more slowly than the group. Because the second hypothesis did not include different levels of punishment, further statistics using a combination of the two threat conditions showed no significant difference between the individuals and the group swimmers, therefore

supporting the second hypothesis. Hence, this study supports the idea that punishment may be used to attenuate the effects of social loafing. Even if this suggestion may be generalized to many different areas, the use of punishment threats may not be appropriate in many situations. Punishment threats may lead to the opposite effect by lowering employee morale or create a general mood of negativity in an organization.

Other Phenomena/Theories that may Affect Group Processes

Research has also focused on possible factors that may influence the social loafing effect and other group processes. Williams and Karau (1991) studied social loafing from a different perspective, testing their social compensation hypothesis which states that individuals will work harder in groups in order to compensate for their poorly performing co-worker when the task is meaningful. One hundred twenty six introductory psychology students were chosen as the participants; 42 of the participants were placed in the low trust condition, 41 were placed in the moderate trust condition, and 43 were placed in the high trust condition, all as a result of scores from the Rotter's Interpersonal Trust Scale (cited in Williams et al., 1991).

Over a series of three experiments in which subjects participated in an idea generation task, Williams et al. (1991) manipulated trust, expected co-worker effort, and perceived co-worker ability respectively. The researchers were able to show support for all of their hypotheses. In collective groups where there was high trust, loafing was apparent; while in the low trust

collective groups, it was found that participants would compensate for their co-workers.

Similar results were found in the high effort and high ability conditions as well; participants working collectively in these conditions tended to loaf while their counterparts in the low effort and ability conditions compensated for their co-workers. The authors also added that while this study supports the social compensation hypothesis, it is not contradictory to the social loafing effect. These results better our understanding of behaviors of individuals working collectively.

Sanna (1992) looked at the self-efficacy theory as another possible influence on social loafing and social facilitation. Bandura's self-efficacy theory (Bandura, 1977, 1986, 1989; as cited in Sanna, 1992) states that an individual's motivation is determined by two factors: the efficacy expectancy and the outcome expectancy. The efficacy expectancy is the individual's belief that he or she is capable of performing the determined behavior; while the outcome expectancy is the individual's belief that the determined behavior(s) will result in a given outcome.

In this study, it was predicted that in the high-efficacy conditions, coactive (i.e., working interactively) participants would perform better than collective and alone participants. The opposite was to hold true for the low-efficacy conditions; the coactive participants would perform worse than the collective and alone participants. The participants consisted of 144

introductory psychology students for each of the two experiments. In the first experiment, Sanna (1992) used a vigilance task in which the subjects were required to respond to flashing dots on a computer screen by pressing an identified key. Efficacy and outcome expectancies had been manipulated according to the different conditions. The results were supportive of the prediction.

In the second experiment, the participants performed the Remote Associates Test; a word associations task. Each RAT item consisted of three words that were somehow related to a fourth word that the subject had to determine. Each subject was assigned to one of three conditions: alone, evaluation, and no evaluation, representing the outcome expectancies. Again, the results were very supportive of the predictions. The findings of this study give support to the social loafing effect, as well as social facilitation, through the self-efficacy theory.

Chapman, Arenson, Carrigan, and Gryckiewicz (1993) combined free riding (i.e., obtaining equal benefits without equal contribution in group processes) with social loafing for their research. In this study, they compared students from two universities, a large private university and a small private university, to look into the effects of cohesiveness on social loafing and free riding. Chapman et al., (1993) hypothesized that the students from the larger university would engage in, and be aware of, free riding behaviors, while the students from the smaller university would not engage in such behaviors due

to greater cohesiveness. These findings would be consistent with the research on social loafing.

Two studies were completed, one at each university, using students enrolled in an upper level psychology class by assigning the participants into groups of three to five. The studies began with 30 subjects in the larger university and ended up with 25 due to attrition over the course of the semester, while the smaller university maintained 35 subjects throughout the semester. Over the course of the semester, the groups received class credit to complete three to four exercises created to strengthen their working knowledge of research methodology. Following the exercises, the participants were given questionnaires about their own behavior, as well as their co-workers. The results from the large university indicated a negative relationship between subjects' own efforts and the level of efforts of others. The students reported a loss of motivation, hence a free rider effect, if at least one other group member was capable and willing to ensure the group's success.

On the other hand, the data from the second study, using the smaller university, demonstrated a positive correlation between subjects' own efforts and the importance of their contribution to the group. These two studies are consistent with previous research on social loafing, in that the social loafing effect will be alleviated or eliminated when there is a high sense of group cohesiveness. One concern may be that the subject attrition in the large

university may have changed the group composition and affected free riding. In the small university sample, free riding may have occurred but because of the tight cohesiveness, the individuals or their classmates may have been hesitant to report such behavior.

Generalizability of the Social Loafing Effect

Atoum and Farah (1993) looked at group cohesiveness from a cross cultural perspective. They used 180 Jordanian college students, whose culture promotes cohesiveness and cooperation, to test the social loafing effect. Identifiability and task involvement were also included in this study. The students were assigned to groups of four and instructed to brainstorm as many ideas as possible in opposition to a comprehensive exam upon graduation. The high-involvement condition was told that the exam was to be adopted at their university by the end of the year. The low-involvement condition was told that the exam would be used at another Jordanian university. Identifiability was manipulated by either separating the subjects' answers (high-identifiability) or compiling the subjects' answers together (low-identifiability). The results were as predicted. The subjects in the high-involvement condition tended to produce more ideas than those in the low-involvement conditions. Similarly, the subjects in the high-identifiability condition also produced more ideas than those in the low-identifiability condition. One interesting finding was that the cell means for the high-involvement condition were higher in both high- and low-identifiability. This

suggests that individuals engaging in high-involving tasks will produce more regardless of the identifiability of the group output. For this study to be generalized to other areas where the culture promotes cohesion and cooperation, additional studies may need to be done in different socioeconomic and educational populations.

The last of the studies presented was influenced by the current trend of technology and computerized work teams. Gallupe, Bastianutti, and Cooper (1991) looked at brainstorming through the use of computers. This was intended to help unblock the brainstorming process by removing the effects of the traditional face-to-face technique. This came about in response to Osborn's (1957) belief that people create more ideas than they can express due to the blocking that occurs from the talking of other people in the group. This technique known as electronic brainstorming (EBS) would also allow one another to feed off each others' ideas without wasting time that is used in the discussion of the ideas. One last benefit would be that some individuals may repress ideas due to fear of embarrassment, while the EBS would allow the individual to contribute ideas anonymously.

Gallupe et al., (1991) used 80 males and 80 females who were bachelor of commerce and Master of business administration students at Queen's University. They were divided into groups based upon two factors: electronic (recording ideas on computer) versus nonelectronic (recording ideas on paper) and nominal (no interaction with other group members)

versus interacting (interaction with each other). The subjects were told to brainstorm as many ideas as possible for advantages and disadvantages that would arise if humans had an extra thumb ("Thumbs Problem", Bouchard & Hare, 1970). Depending upon their condition, the subjects recorded these ideas on the EBS computer terminal alone or in an interacting group, or on paper alone or in an interacting group. The number of nonredundant ideas that were produced by both of the interacting conditions was still less than their nominal counterparts; however, both of the electronic conditions produced more than both of the nonelectronic conditions. Another interesting point is that the participants in the electronic conditions were more satisfied with the brainstorming task than those in the nonelectronic conditions. This could be an important factor for organizations who are concerned with employee satisfaction and morale of the employees.

The Effects of Group Size on Social Loafing

Another element of group work and group research that may affect the social loafing effect is group size. Latane, Williams, and Harkins (1979) found the social loafing effect in the physically exerting tasks of clapping and shouting. As expected, the larger the amount of people clapping and shouting, the more the sound pressure was produced. However, this increase was not proportionate to the group size. It was found that two-person groups performed at only 71% of the sum of their individual capacity, while four-person groups performed at 51% and six-person groups at 40%.

These results lead to a second study that used pseudogroups in order to differentiate between coordination loss and reduced effort.

The psuedogroups were designed so the subjects perceived his or her effort as being pooled with the rest of the group while actually the subjects' output was measured individually. Again, the results showed a reduction in effort in the group tasks. In this study, actual groups of two shouted at 66% of capacity while the two-person pseudogroups shouted at 82% of capacity. The difference between the two groups represents coordination loss. (The same results were found with actual and pseudogroups of six). The authors concluded that half of the difference in group performance is due to reduction in effort.

Ingham, Levinger, Graves, and Peckham (1974) also used group size as a variable in their research on social loafing. Using a rope pulling task, as in Ringelmann's study, it was found that performance declined with the addition of one or two individuals, but the addition of three, four, or five other subjects had no significant affect on performance. The two-person group pulled 91% of the individual pulling mean while the three-person group pulled 82% of the individual pulling efficiency. Further additions of group members resulted in much smaller decrements; a group of six pulled 78% of the average individual performance. This finding was replicated in a second study using pseudogroups to negate any possible coordination losses. Because the reduction in effort tapers off at approximately three individuals, it

may be reasonable to assume that three or four individuals would represent the optimum group size for which social loafing will occur.

Group Structure and its Relation to Performance

One common emphasis within this group research is the effects of structure or intervention on group decision making processes. Maier (1967) states that organization and integration are the most crucial factor in a group's potential. This rationale is the basis for many studies that research the effects of structure and integrative processes on group tasks.

Hall and Watson (1970) chose instructions as their intervening process in an attempt to improve group performance. The study consisted of 148 management seminar students who were divided into 32 discussion groups of four to six subjects. Discussion groups were then randomly assigned to the control or the experimental condition and given the NASA Moon Survival Problem as their decision task. This task requires groups to rank in order of importance for survival 15 items needed when their spaceship had to make a crash-landing approximately 200 miles from their landing spot on the moon. All participants were given identical presentations of material and told to individually rank the 15 items. One copy of the individuals' rankings were handed in to the experimenter and the other copy was taken to the group to be used for discussion.

Half of the groups were then sent to their respective meeting rooms with no further instruction, while the other half received instructions on

how to work on their decision task. These normative process instructions were to guide them toward a 'working through' approach to conflict and decision making. The instructions, presented in written and verbal form, were to reach a group consensus without arguing for one's own rankings, using win-lose statements in discussion, changing one's mind to avoid conflict, or using techniques such as majority vote, averaging, or coin-flipping. They were also instructed to view differences in opinions as helpful, not hindering, and to explore reasons for similar solutions.

The authors hypothesized that the instructed groups would produce higher quality decisions, make more effective use of their resources, achieve a higher level of creativity, and function synergistically to a greater extent than the uninstructed groups. The results showed support for all hypotheses except the one stating that instructed groups would make more effective use of their resources than uninstructed groups. The most important findings were that the instructed groups produced higher quality decisions and that they performed at a greater level of synergy and the groups' decisions were of greater quality than those of their highest performing member. Hall and Watson (1970) suggested that this study implies that it is possible to increase a group's performance by implementing a planned intervention that focuses on group dynamics and processes.

Turner (1992) researched the impact of structure centrality and performance set on group effectiveness under threatening conditions. Group decision time and quality was examined under three intervening variables; communication structure centralization (centralized vs. decentralized), performance set (accuracy vs. speed), and threat (low vs. high). (Because my focus is on the effects of structure, I will be limiting the review of this research to the results which only pertain to the group structure).

Communication structures are an important aspect of this study due to conflicting research regarding the superiority of decision quality produced by the centralized structures (a communication channel where peripheral group members communicate only with one designated member) versus decentralized structures (a structure in which everyone communicates with one another). In decentralized structures, full communication between all members may encourage social loafing or groupthink tendencies, which would result in lower quality of decisions. However, when compared to the centralized structure, full communication may provide an error-checking device which would lead to higher quality decisions. It was Turner's (1992) intention to shed light on the previous conflicting research.

Four person, same sex groups were randomly assigned to each of the conditions and completed a complex task which required participants

to perform logical reasoning operations. The groups were given eight sentences and had to choose the four correct sentences that created a coherent story. The remaining four were distracters and could not be used in the construction of the story. The subjects were told that the final product could consist of three to six sentences in length and sentence order was irrelevant.

Threat was manipulated by varying the importance of the situational loss. High threat groups were videotaped during their session and told that the video would be used for training purposes, while the low threat groups were told they were working on a pilot experiment that had never been used before. Under the performance sets, the accuracy set was told that the object of the task was to complete it as accurately as possible, while the speed set was told the object was to complete the task as fast as possible. Lastly, structural centrality was manipulated by varying communication channels given to the groups. Groups were given either centralized communication channels (the "wheel network") or decentralized communication channels (the "all-channel network") to use. Subjects were restricted by communicating only through written messages.

Performance was measured by quality and time. Performance quality was measured by the number of correct sentences and the number of incorrect sentences. Performance time was measured by the average number of minutes it took for the group members to complete the task.

As predicted, the decentralized structured groups reached a decision more rapidly than did the centralized groups. In the performance set by structural centrality interaction, tests revealed that accuracy set-centralized groups were considerably slower than accuracy set-decentralized groups and both speed set groups. Even though decentralized groups reached their decision more quickly than the centralized groups, they did so without a loss of quality.

The Stepladder Technique

A more recent study in the area of enhancing group performance through intervention techniques was performed by Rogelberg, Barnes-Farrell, and Lowe (1992). In this study, the authors introduced the "stepladder technique"; a new group problem-solving structure. This technique is intended to ensure that all group members are contributing to the process. This is accomplished by structuring the entry of group members into a core group individually. For example, in a four person group the first two members (the core group) come together, present their individual ideas, and work on the task at hand. Then, a third member joins the core group and presents his/her solutions which is followed by a three person discussion. Lastly, the fourth members joins the group and presents his/her solutions. The four members then discuss all options and create a final group decision.

To test the effectiveness of the stepladder technique, Rogelberg et al., (1992) used Johnson and Johnson's Winter Survival Exercise. This task is almost identical to the NASA Moon Survival Task mentioned earlier. Subjects consisted of 120 undergraduate students, which were divided into 30 mixed-gender groups of four. Fifteen groups were assigned to the experimental (stepladder technique) condition and the other 15 to the control condition.

In the stepladder condition, participants were randomly assigned a number between 1 and 4. Participants 1 and 2 were given the experimental packet and allowed seven minutes to complete individually. At the end of this time, participants 1 and 2 were brought together to jointly work on the survival task and Participant 3 was given the packet to complete individually. Participants 1 and 2 were told that the other members of the group would join them in seven minute successions in order to discuss the group's solution, but not to make a final decision until the group was in its entirety. Upon arrival to the group, each group member would present his/her individual solution before any discussions should be held. At the end of another seven minutes, Participant 3 joined Participants 1 and 2 for solution presentation and discussion and Participant 4 was given his/her packet to complete individually. Again, after seven more minutes, Participant 4 joined the group. The entire group was then given 35 minutes to find the one best solution to the task.

Conversely, the control group was given seven minutes to individually complete their packets, then brought together to complete the packet together. They were told they could arrive at the one best solution any way they wanted. They were given 45 minutes to brainstorm and chose the one best solution.

It was hypothesized that the groups using the stepladder technique would generate higher quality decisions than the control group. In addition, it was expected that the experimental group would produce greater improvement than the control group over average individual solutions. Also, the experimental groups was predicted to have a higher frequency of group decision quality surpassing the best member's solution. All these hypotheses were proven to be correct. The authors concluded that this study provided evidence that the stepladder technique provided a structure that enables group members to perform at a higher level of quality.

Present Study

The emphasis of the present study is to evaluate the impact of an imposed group structure on group productivity and outcome quality. More specifically, the study will implement the stepladder technique in hopes to replicate similar results to the Rogelberg et al., (1992) study. However, the present experiment will use an applied organizational type problem solving task rather than a Survival Task exercise to more closely represent common

problems that work teams or groups found in today's work force might encounter.

Besides the different type of problem solving task used, the present study will also add a condition of subjects who will complete the task individually. This will be done in order to compare individual and group problem solving in terms of quantity and quality.

Method

Subjects consisted of 90 introductory psychology course students from a mid-sized Mid-Atlantic university. The subjects received extra credit for their participation. The experiment was held in a laboratory setting at the university and conducted by the experimenter and trained research assistants. The subjects were randomly assigned to groups of four and completed The Case of the Sewing Machine Operators (see Appendix A). Gender within the groups was not manipulated in order to be able to generalize the results to actual organizational settings. It was assumed that gender composition was not a determining factor in the organization or development of a group.

The subjects were randomly assigned to one of three conditions; the stepladder technique group, the unstructured group, or individuals working alone. Each subject was given their experimental packet at the beginning of the experiment. The packet included The Case of the

Sewing Machine Operators scenario and script (Appendix A), a diagram of the sewing room layout (Appendix B), written instructions for the experiment (Appendix C), and one of two answer sheets. One of the answer sheets was used to record the individuals' solutions (Appendix D) and the other to record the groups' solutions (Appendix E). The experimental packet was given to the experimenter at the end of the experiment. The experimenter read the instructions and the case scenario to the group for the first 15 minutes of the experiment. The subjects then proceeded as follows:

Stepladder technique. Subjects in the experimental condition were randomly assigned a number 1 through 4 to indicate their position in the group. After all instructions and the scenario were read, Subjects 1 and 2 were taken to another room in order to work on the problem together. They were told that the other participants would be joining the group and there should be no final decision made until all four members of the group are present. At the same time, Subject 3 was told that he or she would be joining the core group in eight minutes. After the eight minutes were through, Subject 3 would join Subjects 1 and 2. At this same time, Subject 4 was told that he or she would join the group in eight minutes. Lastly, after eight minutes, Subject 4 joined the group. It was recommended to the group that each member should present his/her solutions upon entering the group. Once all group members were present, the group had

20 additional minutes to generate as many solutions as possible as well as identify one best solution.

Unstructured group. After all instructions and the scenario were read, the group was instructed to work together to generate as many solutions as possible. Additionally, the group was told to determine the one best solution. It was explained that the group may arrive at a group solution using any technique. A time limit of 35 minutes was set for this group. This time limit was approximately the same as the combined time of the experimental ("stepladder") condition.

Alone. After the instructions and case scenario had been read thoroughly, the subjects were given 35 minutes to complete the problem. They were asked to generate and record as many solutions as possible as well as to identify their one top or best solution to the problem.

There were two dependent variables that were measured: number of solutions and quality of solutions. The number of solutions was measured by counting the recorded solutions by the individuals and the group. The quality was measured by using a quality scale (Appendix F) to compare the groups' and individuals' chosen best solution. The quality scale was developed by using solutions provided by four upper- level managers from a large utility company. The scale ranged from one (low quality) to five (high quality).

Hypotheses

Using previous research on group productivity, social loafing and the stepladder technique as a basis, it was hypothesized that:

1. The alone condition would generate a greater number of possible solutions than both the unstructured and stepladder groups.

2. The stepladder groups would produce more ideas than the unstructured groups.

3. The stepladder technique would produce higher quality decisions than both the alone and unstructured groups.

If the results support these hypotheses, this study will give support to the impact of an imposed group structure on group productivity and outcome quality as well as compare individual and group productivity. It will also shed light on the effectiveness of the stepladder technique. Because it combines individual accountability and a group function, it will hopefully result in a high quality decision making process.

Results

The quantity and quality of responses produced by the various experimental conditions were analyzed to determine whether there were significant performance differences between the unstructured groups, the stepladder technique groups, and the alone condition. Cell means were calculated and are presented in Table 1.

Two separate analysis of variance (ANOVA) procedures were conducted; one for quantity of solutions and one for quality of solutions.

The ANOVA results revealed no significant difference for solution quantity ($F(2, 34)=.403$, $p=.672$) and no significant difference for solution quality ($F(2, 34)=.647$, $p=.530$). The ANOVA results therefore indicated that none of the experimental hypotheses were supported.

Discussion

The purpose of the present study was to reevaluate the effectiveness of stepladder group problem-solving and apply this technique to a more applicable and applied organizational brainstorming activity. Although none of the experimental hypotheses were supported, these results do not indicate that the stepladder technique is inadequate at producing a high number of quality decisions. I believe the type of problem used was the variable that had the most profound effect on the results.

The sewing room scenario problem seemed to have a ceiling effect. There is somewhat of a limit to the amount of reasonable solutions to the scenario, especially for subjects with limited exposure to applied industrial settings or problems. While observing the groups during this experiment, I noticed that many groups had decided on their final solutions approximately five to ten minutes before their maximum time limit. (However, each group was required to complete the entire time requirement.) In the stepladder conditions, I noticed that many of the groups had completed their solutions before the final subject entered the group.

In the winter survival task used in the first study by Rogelberg et al., (1992), the number of possible solutions far outweighs the time limit (even though quantity of solutions was not measured in the original experiment). The winter survival task has 210 possible solutions (N x N – 1 = X) with a 45 minute time limit, whereas the number of possible solutions for the sewing room scenario problem would be assumed to be much less with a 30 minute time limit. The mean number of solutions provided by all three conditions was 10.58, while the maximum number of solutions provided by any group was 16.

Another difference between the studies is the type of solution. The winter survival task used in the first study was a rank order solution. In the present study the task required the groups to brainstorm, with the type of solution being quantity based. The goal was to provide as many solutions as possible. I believe this would be an appropriate future direction for further research of the stepladder technique.

In response to the lack of support for the hypotheses regarding the quality of solutions, I believe the Quality Response Scale could have included responses from management professionals from different companies. The responses were obtained from four management professionals from one company which may have fostered similar ideas. After reviewing the scale at the end of the experiment and discussing these with one of the contributors, we noticed that the responses reflected

the current events of the company. For instance, many of the responses found in the A category (5 points) were currently being introduced within that company. It would have been more effective to have more professionals from different organizations complete the task to use as a basis for the quality scale.

Although the present study produced no significant results, I believe it still has some merit. It has introduced a brainstorming task to the stepladder technique to help give a new direction to future research. During the experiment phase, I also noticed that groups using the stepladder technique had better communication that involved all the participants. This is a key element in group processes. With further research, the stepladder technique may prove to be an effective tool to enhance the small group decision making process. The only negative aspect I would consider is the practical application of such a technique. As compared to more traditional group processes, it might be more time consuming when first introduced to an organization, as well as more difficult to implement. Further studies may be able to highlight its usefulness and boundaries.

Appendix A

The Case of the Sewing Machine Operators - Adapted from Maier, N.R. F. (1955). Psychology in Industry. Houghton Mifflin Co, Boston, p. 39.

The Problem Solving Scenario

For the past six months James Gilmore has been the supervisor of a sewing room of twenty five employees in a garment factory. The employees are all union members. Until recently, his main problem was that of getting out enough production. Three months ago, however, all sewing machine operators were changed over from hourly to a team piece-rate system so that production has become fairly satisfactory. Quality is now the big problem; not only are there too many rejects, but serious complaints are coming in from salesmen in the field. Since the employees are not paid for rejected items, it is difficult to understand why they are not more careful.

Supervisor Gilmore met with his department foreman, Eric Holtzman to discuss the matter. Their conversation appears below.

Mr. Holtzman: James, I want to talk to you again about the kind of work your unit is turning out. What's the matter down there?

Mr. Gilmore: Darn it, I don't know. On the old hourly rate the employees weren't turning out anything and now on this new group

piece rate a lot of the work they do isn't any good. When I make them do it over they say that I am picking on them.

Mr. Holtzman: The other supervisors aren't having the trouble with their employees that you do with yours.

Mr. Gilmore: Well, I'm not having trouble with all of mine. There is just this small group of five or six who are the real trouble makers. They all want to be finishers and anything but what they are. I've got them spotted next to my desk where I can keep an eye on them, and I tell them that I won't move them until they learn to cooperate. Even so, I'd like to see the other supervisors get any work out of them.

Mr. Holtzman: You're not trying to tell me that just a few employees out of more than two dozen make your crew look that bad?

Mr. Gilmore: No, but they are the worst ones. I called all the employees in the "C" and "D" teams together last week and gave them a good talking to and now they're worse than ever. Production and quality are both down.

Mr. Holtzman: I'm beginning to think that you don't have any that are any good.

Mr. Gilmore: No, that's not right. I'll take the employees in my "A" team and put 'em against any we've got. As a matter of fact, all my finishers are a pretty decent bunch. The "B" team has a couple of good workers in it and there is nothing wrong with the "E" team.

Mr. Holtzman: Yeah, but their rejects are too high.

Mr. Gilmore: Well, that might be true, but those employees certainly produce. Maybe if I can get them to slow down a little the quality will go up. It's going to make them sore though.

Mr. Holtzman: That's your problem. You're not afraid of them, are you?

Mr. Gilmore: No, but they didn't even like it the other day when I got after them for talking on the job. Come to think of it all that gabbing may be the reason they don't pay attention to quality.

Mr. Holtzman: Well, tell them that if they don't stop talking you'll break up their little club. You're the boss down there, aren't you?

Mr. Gilmore: Well, you've kind of got me there. I hired everybody in the "E" team in one batch with the understanding that they could work together and I hate to go back on my word.

Mr. Holtzman: Well, give them a good lecture and threaten to do it.

Mr. Gilmore: I know, but it's a headache and those employees stick together and you can't locate the troublemaker. Even when employees don't get along too well they gang up on you. For example, I gave these employees on team "C" a safety lecture the other day after one of them got her hands caught, and all they did was gripe and pick on me about everything under the sun. I never saw such a bunch of sour employees before in my life.

Mr. Holtzman: What's eating them anyway? Certainly there must have been something they picked on.

Mr. Gilmore: Oh, it was the same old yapping about all of them wanting to be finishers. After they've been on the job a few weeks they think they know everything.

Mr. Holtzman: Sounds like you've been giving some of the employees a lot of half-baked ideas about the jobs around here. What's there to being a finisher anyway? The pay is the same.

Mr. Gilmore: I don't know. I think it's just a dumb idea they've got in their heads. You know how employees are. I know the end job isn't any easier.

Mr. Holtzman: Was that all they griped about, or do they want us to give 'em the factory too?

Mr. Gilmore: No. Quite a few of them were sore because they said they couldn't make standard. Most of the employees think the expected minimum production level is too hard to hit anyway.

Mr. Holtzman: I haven't heard any other complaints about it. After all, 80 isn't so high. Why should your employees complain when none of the rest of them do?

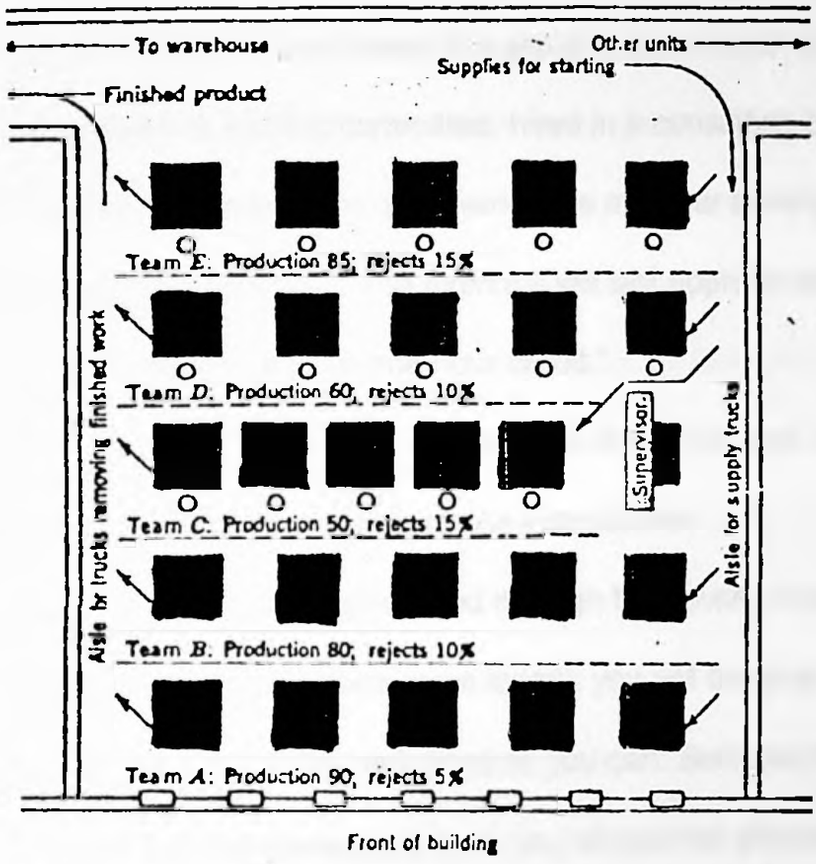
Mr. Gilmore: All I know is that they do. Except team "A" and a few others who really turn the stuff out, they're just about the worst bunch of goof-offs I ever saw. I don't know why I have to have all of them.

Mr. Holtzman: James, we've been over all of this before and I'm tired of listening to you feel sorry for yourself. Either get those employees on the ball, or we'll have to put somebody down there who knows how to run things. I don't want to be rough about it, but that's the way it is. I'll give you 30 days to get that mess straightened out, and I'll back you up on anything that seems reasonable. If you can show me some results by the end of that time, you can stay; if you don't, we'll have to find something else for you. Is that clear?

Mr. Gilmore: I guess so. But after racking my brains like I have for the past six months, I don't know what you or I or anybody else can do with those employees. I've tried everything.

Appendix B

Sewing Machine Room Layout



Appendix C

Group Instructions.

The following instructions were included in the experimental packets given to all subjects as well as read to the subjects by the experimenter.

"You are about to participate in a group problem solving exercise in the role of a problem solving committee, hired in a consulting capacity by James Gilmore, the supervisor of a twenty-five member sewing machine division in a garment factory. The exercise will last approximately one hour for which you will receive one hour credit."

After the introductory instructions were distributed and read, the "alone" condition was given the following instructions:

"After you have thoroughly read through the sewing room scenario and studied the sewing machine room layout, you will be given 35 minutes to generate as many possible solutions as you can. Because this is a brainstorming and idea generating task, you should not eliminate any of your ideas due to uncertainty. The goal is a large quantity of solutions. These should be recorded on the provided answer sheet (Appendix D). Please explain in short and concise detail. After you have exhausted all possibilities, please evaluate your solutions and identify your best solution by circling the solution. Hand the complete experimental packet into the experimenter when finished."

After the introduction, the unstructured groups will be given the following instructions:

"After each of you have read the sewing room scenario thoroughly and studied the sewing room layout, the experimenter will ask you to join the other group members and allow 35 minutes to generate possible solutions. At this point, the group should designate a 'group recorder' to record the group's solutions on the provided group answer sheet (Appendix E). Please be short and concise in the description of each solution. Each group member is encouraged to participate and provide input. The goal is to provide the most solutions as possible. After the group exhausts all possibilities, the group should designate one best solution by circling the solution. Be aware of the 35 minute time limit in order to give yourselves time to decide on the one best solution. At the end of the 35 minutes, each subject will give the experimenter all of the experimental packet including group answer sheets."

After the introduction, the stepladder groups will be given the following instructions:

"After each of you have read the sewing machine thoroughly and studied the sewing machine room diagram, you will begin using the stepladder technique to assist you in the group problem solving process. Participants 1 and 2 (the core group) will be taken to a separate room to work on the task together. At this time the remaining participants may

choose to work on the task or not to work on the task. Participants 1 and 2 should allow one another to express their solutions to each other and begin discussing possible solutions. After eight minutes, Participant 3 will join the core group to present his or her solutions. Again, the core group will then continue discussing the possible solutions. After another eight minutes, Participant 4 will join the core group and present his or her solutions. Not before all four members of the group are present should any final decisions be made on the possible solutions. Once the fourth participant joins the core group, the group will have 20 minutes to generate additional solutions as well as designate on best solution. The group will designate 'group recorder' to record the group's solutions on the provided group answer sheet (Appendix E). Please circle the group's one best solution. At the end of the time limit, all experimental materials will be given to the experimenter before leaving."

Appendix D

Individual Answer Sheet

Please record all solutions you have generated on this answer sheet. If additional space is needed, use the back of the paper or ask the experimenter for additional paper. Remember to circle your one best solution. This must be given to the experimenter before leaving the experiment.

Appendix E

Group Answer Sheet

Please record all solutions the group has generated on this answer sheet. If additional space is needed, use the back of the paper or ask the experimenter for additional paper. Remember to circle the group's one best solution. This must be given to the experimenter before leaving the experiment.

Appendix F

Quality of Responses Scale

The following are five levels of responses based on the frequency of ideas provided by four management professionals.

5 points (high quality):

- Mix people on teams based on skill levels, experience, abilities. You need a good mix of personnel on each team for better performance.
- Have each member of the team rotate jobs within the team on a routine basis.
- Mix the members of the "A" team within the other teams.
- Cross-train between teams.
- Move employees between teams.
- Rearrange the workroom so that the teams face vertically from the front to the back.
- Have the production start at the front of the building since the finishing jobs seem to be the most rewarding.
- Move teams around and see if ergonomics is part of the problem.
- Move Team C to Team E's spot; closer to supplies.

4 points:

- Perform focus group discussions on employee ideas for improvements.
- Form Quality Improvement Teams (ongoing) with mix of employees from each team to provide continuous development and monitoring of quality improvement.
- Start a Quality Assurance Team with team members.

- Establish bonus program for repeated superior production with minimal defects.

- Reward teams with bonuses for production less rejects. Reward teams for net production above 80; the higher above 80, the higher the reward.

- Implement a merit system that pays for both production and quality.

3 points:

- Develop highly visible monitoring tools (graphs on the wall) to broadcast production and rejects.

- Develop a competition with teams (display charts); recognize "winners".

- Place supervisor in the middle of the floor.

- Supervisor needs to move around with employees.

- Once poor performers have been given ample opportunity to improve, if they have not, employee should be dismissed.

- Have Mr. Gilmore release his trouble employees.

2 points:

- Provide break time in an employee lounge for "chat time" so work time can be more focused.

- Have ongoing, periodic safety meetings.

- Never commit to employees during hiring phase about where they will always work and with whom they will always work.

- After review and documentation of employee performance, provide periodic, frequent feedback/coaching (especially to poor performers).

- Let the teams pick out their own team names.

- Let the teams self-manage themselves.

- If the teams don't meet production levels, let them know the entire team will suffer the consequences.
- Provide more quality training.
- Release Mr. Gilmore.
- Transfer Mr. Gilmore to another group.
- Have Mr. Holtzman give the C Team a pep talk.
- Have a salesman or two come in and explain the problems they are having.
- Go back to hourly rate.
- Explain to the C Team what each individual's role is.

1 point (low quality):

- Any solution not provided by management professionals.

Table 1

Cell Means of Solutions By Condition

	Stepladder (n=10)	Unstructured (n=10)	Alone (n=17)
*Quantity	11.20	10.40	10.12
**Quality (1=low; 5=high)	4.10	4.30	3.82

*number of solutions provided by subject or experimental group

**quality of the one best solution chosen by subject or experimental group and compared to the Quality Response Scale (Appendix F)

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