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The Stepladder Technique: An Alternative Group Structure Facilitating Effective Group Decision Making

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A new group problem-solving structure entitled the *stepladder technique* is introduced. The stepladder technique is intended to allay the problems associated with group decision making by structuring the entry of group members into a core group and by ensuring that each member contributes to the decision-making process. Four-person groups, randomly assigned to either the stepladder group condition (15 groups) or the conventional group condition (15 groups), performed Johnson and Johnson's (1987) winter survival exercise. Stepladder groups produced significantly ($p < .05$) higher quality decisions than did conventional groups (in which all members entered and worked on the problem at the same time). Furthermore, stepladder groups' decisions surpassed the quality of their best individual members' decisions 56% of the time. In contrast, conventional groups' decisions surpassed the quality of their best members' decisions only 13% of the time.

Organizational problems and issues are frequently addressed by small groups of executives, managers, or workers who constitute temporary formal groups. Schein (1965) defined temporary formal groups as "committees or task forces that may be created to carry out a particular job but which, once the job is carried out, cease to exist unless some other task is found for them" (Schein, 1965, p. 68). Twenty-five years later, Sundstrom, De Meuse, and Futrell (1990) re-emphasized the importance of the temporary formal group, which they renamed *projects and development*. Sundstrom et al. described this work-type application as groups (task forces, research groups, planning teams, development teams, etc.) requiring high differentiation of members' skills, little synchronization within the organization, and life spans that typically differ for each new project. Creating new products, rewriting organizational policies, solving organizational problems, and developing marketing proposals are examples of tasks that may be addressed by temporary formal groups. The decision to employ a temporary formal group instead of an individual for a particular problem typically stems from the belief that a solution produced by a group of individuals working together will be superior to the solution produced by an average individual.

Assessing the Performance of Decision-Making Groups

Previous studies of group decision making have assessed group performance in three ways. First, in some studies, the quality of one group's decision has been compared with the quality of another group's decision (Bottger & Yetton, 1987; Hall & Watson, 1970; Miner, 1984; Nemiroff & King, 1975). Second, some studies have focused on the extent to which the group's solution improves on the average of the individual members' solutions. Studies of this sort have generally found that a group's score is better than the average of individual members' scores (Bottger & Yetton, 1987; Hall & Watson, 1970; Nemiroff & King, 1975). Third, a number of studies have focused on how often groups' solutions are better than the solutions of their best members. Usually group performance has been found to be inferior to the performance of the best individual (Burleson, Levine, & Samter, 1984; Hill, 1982; Libby, Trotman, & Zimmer, 1987; Yetton & Bottger, 1982). Overall, groups perform better than their average individual member and worse than their best individual member. These findings suggest that groups are not performing optimally. Maier (1967, p. 239) suggested, "If the potentials for group problem solving can be exploited and if its deficiencies can be avoided, it follows that group problem solving can attain a level of proficiency not ordinarily achieved." Generally, it appears that groups are not able to avoid these deficiencies when making decisions, or they would regularly be equaling or surpassing the solution of their best members. Ideally, the concept of a small group of people working together, capitalizing on each other's diverse knowledge and differing perspectives, and finally creating an effective solution for a difficult problem, is attractive. Yet this ideal is rarely achieved.

Problems Associated With Group Decision Making

Research on group decision making has identified several problems that often lead to ineffective decisions. In some instances, for example, group communication may be limited because members who are shy, lack communication skills, or are dominated by other group members may not communicate their ideas (Johnson & Johnson, 1987, p. 91). Even if a group member does communicate his or her ideas, an egocentric member's unwillingness to understand other members' perspectives can result in group decisions that are low in quality

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(Falk & Johnson, 1977). These limitations can lead to the inefficient or incomplete use of information that could be relevant to the group's decision.

In other instances, social pressure within the group may lead to conformity behaviors, which in turn tend to favor acceptance and silence-disagreement (Maier, 1967). Janis (1982) found that cohesive groups often have more concerns for unanimity than they do for evaluating different courses of action.

A somewhat different problem, called *social loafing* (Latane, Williams, & Harkins, 1979) occurs when a person's group problem-solving efforts are less then his or her individual efforts would be if he or she was working alone. In other words, social loafing refers to an individual's reduction of effort when working in a group, compared with the amount of effort exerted when working alone. This phenomenon is observed when group members assume that their personal contribution can be reduced simply because others have made or will make contributions.

A solution to the aforementioned dilemmas and problems may be to create a group structure that lessens social pressure, decreases social loafing, and promotes communication and information extraction. In this study, we examined such an approach, which we call the *stepladder technique.*

Stepladder Technique

The stepladder technique is intended to enhance group decision making by structuring the entry of group members into a core group. Increasing or decreasing the number of group members alters the number of steps. In a four-person group, the stepladder technique has three steps. Initially, two group members (the initial core group) work together on the problem at hand. Next, a third member joins the core group and presents his or her preliminary solutions for the same problem. The entering member's presentation is followed by a three-person discussion. Finally, the fourth group member joins the core group and presents his or her preliminary solutions. This is followed by a four-person discussion, which has as its goal the rendering of a final group decision.

The stepladder technique has four requirements. First, each group member must be given the group's task and sufficient time to think about the problem before entering the core group. Second, the entering member must present his or her preliminary solutions before hearing the core group's preliminary solutions. Third, with the entry of each additional member to the core group, sufficient time to discuss the problem is necessary. Fourth, a final decision must be purposely delayed until the group has been formed in its entirety.

The stepladder technique may prevent group deficiencies from occurring for a number of reasons. The structure and dynamics imposed by the stepladder technique should facilitate communication. All group members, be they the initial interacting dyad or entering members, must communicate their thoughts or ideas. This communication mandate may lead to a greater number or range of ideas being expressed; furthermore, it may reduce the likelihood of social loafing. Because social loafing stems from a member's ability to hide behind other members' contributions, the stepladder technique may obviate the tendency to loaf.

Critical decision making results when groups freely evaluate ideas, do not actively avoid disagreements, and do not allow blind conformity. Critical decision making may occur in stepladder groups. The constant addition of new group members into the stepladder core group should lead to fresh ideas that are untainted by group norms. Along with the entering member's fresh ideas comes potential controversy (a different solution). A different solution could lead the group to do more evaluating and second guessing of contrasting ideas. Cosier and Schwenk (1990) suggested that fostering disagreement in a structured setting may actually lead to better decisions. In addition, because the group is not formed in its entirety until the last member joins the core group, pressure to reach or conform to a premature solution may be delayed until considerable information has been shared.

The final reason that the stepladder technique may enhance group decision making concerns the role of the best member within each respective group. Because the stepladder technique mandates communication and because the act of communicating may reveal knowledge, individual expertise may subtly be made known. If expertise is made known, the group may allocate more time for the best member to express ideas and concerns. Recent research suggests that, when best members are allocated more time for communication, group decision quality is likely to be enhanced. Zalesny (1990) found that the most accurate member in interacting groups did not influence group ratings unless he or she was assertive and confident. In addition, Bottger (1984) found that "air time" (amount of communication) and expertise were correlated in high-performing groups and uncorrelated in groups that performed less well.

The present study was an initial examination of the usefulness of the stepladder technique as a means of enhancing the quality of small groups' decisions. The goal of the study was to determine whether the technique, employed with a group of four people solving a complex and creative problem, would increase the quality of a group's decision. If the technique does enhance group decision-making effectiveness under these conditions, the manner in which the stepladder technique affects group functioning and the boundary conditions for its usefulness should be further explored in additional studies.

Experimental Hypotheses

Overall, it was expected that the problem solutions generated by groups using the stepladder technique would be of significantly higher quality than the problem solutions generated by groups using a conventional group structure. Three related but more specific hypotheses addressed this issue.

Hypothesis 1. It was expected that the problem solutions produced by groups using the stepladder technique would be significantly more similar to expert solutions than would problem solutions produced by conventional groups.

Hypothesis 2. It was expected that the improvement of group solutions over the average of individual member's prior solutions would be significantly greater for stepladder groups than for conventional groups.

Hypothesis 3. It was expected that the quality of group solutions would surpass the quality of best members' solutions sig-

nificantly more frequently for the stepladder groups than for conventional groups.

Method

Subjects

Students (48 men and 72 women) enrolled in undergraduate psychology courses at a large state university in the eastern United States participated in the study for experimental credit. Because mixed-sex group composition and variability in the extent to which previous relationships exist among group members are typical of temporary formal groups in industrial settings, these variables were measured but not constrained or manipulated in this study. There was an equal proportion of men and women within each of the two experimental conditions. The number of previous relationships existing among group members in the two conditions was similar across groups (a mean of .8 existing relationships out of six possible acquaintances per group in both conditions).

Design

Groups of subjects were randomly assigned to either the stepladder group condition ($n = 15$ groups) or to the conventional group condition ($n = 15$ groups). The study used a single-factor, between-groups design. The independent variable (group type) had two levels: stepladder and conventional. This variable was manipulated through task instructions given to the participants. Three dependent variables were measured: group decision quality, group improvement, and the frequency with which the group decision quality surpassed the best members' decision quality.

Materials

Experimental task. The problem-solving task used was Johnson and Johnson's (1987, p. 110) winter survival exercise. The winter exercise is nearly identical to the popular moon survival exercise (Hall & Watson, 1970), which has been accepted as an analogue to the types of problems faced by managers (Bottger & Yetton, 1987). In general, the novel and complex winter survival task was chosen because it resulted in a solution that could be analyzed quantitatively for decision effectiveness. To solve the winter survival problem, participants imagined that an airplane in which they were traveling had crashed in a remote northern area during the winter. Participants rank ordered 12 items remaining from the crash in terms of their importance to survival. Multiple and subtle uses existed for each item alone and in combination with other items.

Performance on the winter survival exercise was defined as the sum of the absolute differences between the ranks assigned by participants for each item and those advocated by three wilderness experts: M. Wanvig (U.S. Army survival training instructor), R. Johnson (environmental education expert), and C. Rulstrum (author of *New Ways of the Wilderness*). A low score (little absolute difference between the experts' ranks and the participants' ranks) indicated a highly effective decision. A higher score (large absolute difference between the experts' ranks and the participants' ranks) indicated a less effective decision.

Postexercise survey. In addition to solving the winter survival problem, 88 participants responded to 15 questions designed to assess perceptions of group productivity, group effort, and group climate.[1]

Procedure

When a four-person group arrived at the experimental location, the numbers 1 through 4 (without replacement) were randomly assigned to participants. The participants' gender and the number of previously existing relationships between group members were recorded. A packet was given to each participant before he or she participated in the problem-solving group. The packet contained two copies of the winter survival exercise and procedural instructions. After completing the winter survival exercise, the participant transcribed his or her answers onto both copies of the exercise; one copy was to be given to the experimenter and the other copy was to be kept for a reference. In addition, procedural instructions explained that the group task was the same as the individual task and that the group goal was to come up with one best solution that was as close as possible to the solution that the winter survival experts developed when given the same problem. Furthermore, to facilitate individual and group motivation, groups were instructed that they would be told how their group solution compared with the experts' and their peers' solutions.

Stepladder technique. The numbers assigned earlier served as the order of entry for the participants. First, Participant 1 and Participant 2 were given the experimental packet to complete individually while the other two group members read the daily newspaper in silence. After 7 min (a period of time chosen on the basis of pilot testing), Participant 3 was given the experimental packet to complete individually, and Participant 4 continued to read the newspaper. Meanwhile, Participant 1 and Participant 2 were taken to an adjoining room (in which four chair-desks were arranged in a circle) to work on the problem together. They were instructed that in 7 min one of their group members would join them and hence they were not being asked to make a final decision. After another 7 min, Participant 4 was told to complete the experimental packet, and Participant 3 was taken into the room where the two other members were. The three-person group was reminded that the entering member should present his or her individual solution first and that in another 7 min the final group member would join them. Seven min later, Participant 4 joined the group. Participants were again reminded that the entering member should present his or her individual solution first. They were also told that they had up to 35 min to create the one best solution for the problem. A summary of the stepladder procedure is presented in Figure 1.

Conventional group. After taking 7 min to individually complete the winter survival exercise, participants in the conventional group condition were instructed that they would all work together (in the same room that the stepladder groups worked in) to create the one best solution for the problem. It was explained that they could derive a group solution any way they wanted. They were also informed that they had up to 45 min to generate alternatives resulting in a final decision. A summary of the conventional group procedure is presented in Figure 2.

Task time and posttask survey. Because the amount of time spent on problem solving may influence the quality of the decision, the potential time available to spend on problem solving was held constant across the two conditions. Because the two experimental groups differed in structure, time was recorded in terms of "people minutes" (the amount of time each individual spent working in the group).

After the group submitted its group decision to the experimenter, individual members completed a short questionnaire. Participants

[1] Some data were collected before the survey was completed and pretested. The first eight groups tested (four in each condition) were not given the postexercise survey. All members of the 22 groups (out of 30 groups) that were given the survey completed the survey in its entirety.

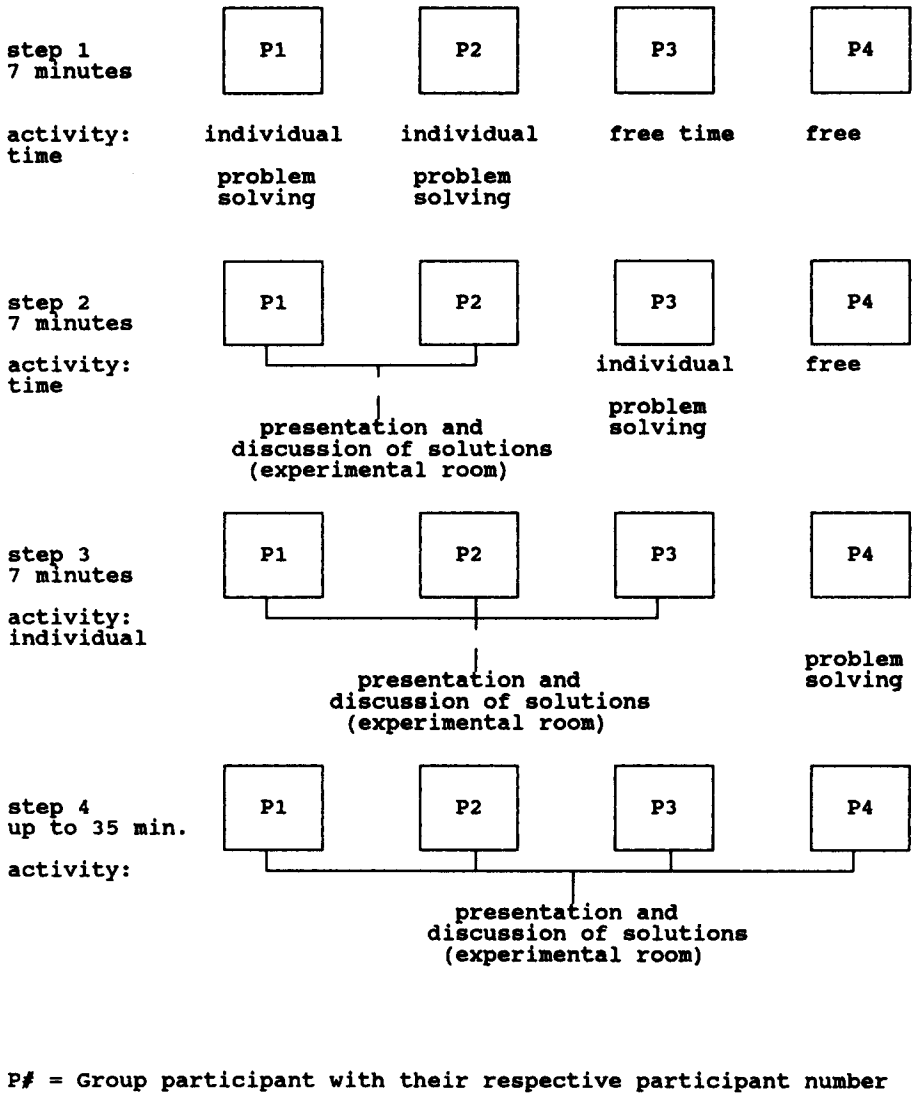

Figure 1. Experimental procedure for stepladder groups.

were then debriefed and given performance feedback regarding the effectiveness of their group's solution.

Results

All three hypotheses were supported by the data. Table 1 presents summary statistics for all dependent variables.

Prior Individual Resources

Differences between recorded rankings and the experts' rankings were calculated for each individual and each group. The individual rankings were obtained before the group interacted and thus represented prior available resources. The mean of the four individual ranking scores for each group (the mean individual resource score [MIRS]) was calculated. The mean MIRS scores for the stepladder groups and the conventional groups did not differ, $t(28) = 0.95$, *ns.* In addition, the mean of the best individual solutions (the solution of the one member in each group who had the best initial solution) for the stepladder groups and the conventional groups did not differ, $t(28) = 0.78$, *ns.* Thus, group equivalence with respect to prior resources was assured. In addition, individual resource scores for the stepladder group members did not differ with respect to their order of entry (participant number) into the group, $F(3, 56) = 0.47$, *ns.* In other words, on average, the abilities (individual scores) of participants entering stepladder groups on the first step, the second step, or the third step did not significantly differ.

Time Taken to Arrive at a Solution

The time span measured began when the core group united and ended when a final solution was given to the experimenter. None of the groups, regardless of condition, approached the time limit or needed reminding to finish. The time spent work-

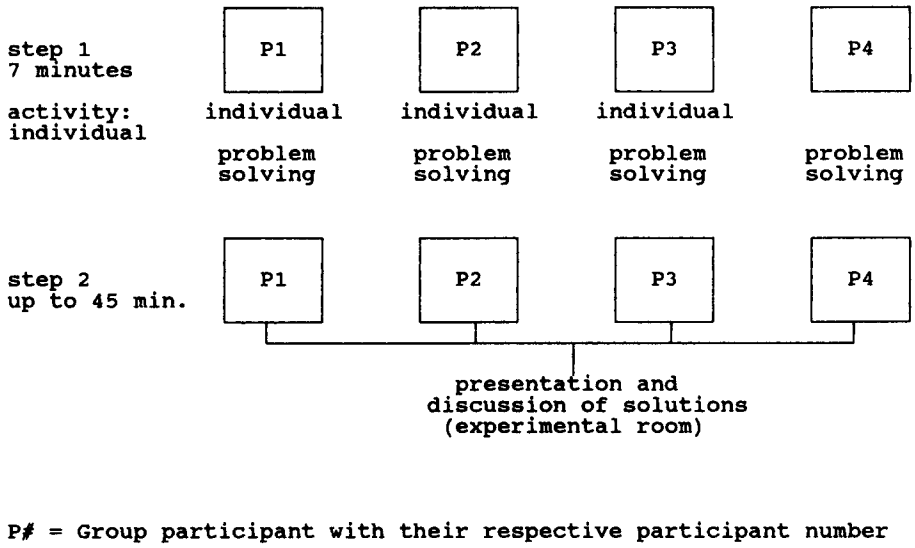

Figure 2. Experimental procedure for conventional groups.

ing on the task for the stepladder groups and the conventional groups did not differ, $t(28) = -0.49$, *ns.*

Test of Hypotheses

Overall, the problem solutions generated by groups using the stepladder technique were of significantly higher quality than the problem solutions generated by groups using a conventional group structure.

Hypothesis 1. Rankings obtained from stepladder and conventional groups were compared. As expected, the mean group decision produced by stepladder groups was significantly better than the mean group decision produced by conventional groups, $t(28) = 2.27$, $p < .05$.

Hypothesis 2. Difference scores were generated by taking the final group ranking score and subtracting the average prior resources score. This difference score acted as an index of group improvement over the average individual score. The greater the negative number, the more improvement that occurred. As hypothesized, the mean difference score for the stepladder groups showed significantly greater improvement (based on separate variance estimates) than did the mean improvement score for the conventional groups, $t(28) = 2.13$, $p < .05$.

Hypothesis 3. The frequency with which the group ranking score was better than the individual best member's score was calculated for both types of groups. As predicted, the stepladder groups' rankings surpassed their best members' rankings

Table 1
Summary Statistics for Variables Measured in the Study

	Conventional groups ($n = 15$)		Stepladder groups ($n = 15$)	
Dependent measure	*M*	*SD*	*M*	*SD*
Time used	83.06	37.5	88.67	23.50
Average individual resources	51.10	3.08	50.02	3.12
Best individual member's score	44.20	5.71	42.46	6.46
Group decision score[a]	48.27	5.08	43.20	7.01*
Group score improvement over average individual's score[a]	−2.83	3.66	−6.82	6.26*
Proportion of groups beating their best member's score[a]	133		533	

Note. The lower the decision score, the greater the decision quality.
[a] Means for conventional groups and stepladder groups differed significantly for these dependent measures ($p < .05$).

significantly more often than in the conventional groups, $\chi^2(1, N = 30) = 3.75$, $p < .05$ (Yates' correction used).

Group Perceptions

To explore differences in the perceptions of conventional and stepladder group members, between-groups t tests were used on responses to the survey questions. Seven of the 15 items revealed significant differences between the two groups ($p < .05$). Because these comparisons were exploratory in nature, no attempt was made to control the familywise Type I error rate. All items are displayed in Table 2.

On the basis of a factor analysis, the survey questions were grouped into three categories: (a) group climate questions, (b) group effort questions. and (c) group productivity questions (Rogelberg & Barnes-Farrell, 1991). Questions that revealed significant response differences were found in each of the three categories. For the group climate questions, stepladder groups' members agreed more strongly that they felt less pressure to conform, that they all agreed on the final product, that they worked unusually well together, and that their groups were more friendly. For the group effort questions, stepladder groups' members agreed more strongly that they worked harder on the task. For the group productivity questions, stepladder group members reported that their group solution was better than the solution of another average group working on the same problem.

Stepladder and conventional groups members within each group were rank ordered according to their prior individual scores (from best to worst). Two analyses of variance (one for each group type) were conducted to determine if the perceptions (using the exploratory questionnaire) of differently ranked members would differ. No differences in group perceptions were found for differently ranked individuals in either the conventional groups or the stepladder groups, with one exception. The best members in the stepladder groups were more likely to

Table 2
Summary of Responses to Survey Questions

	Group				
	Conventional		Stepladder		
Survey questions	*M*	*SD*	*M*	*SD*	*t*(86)
Was your group's solution better or worse than your own individual solution?[a]	3.97	0.66	4.11	0.69	—
On the average, was your group's decision better than other groups' decisions on the same task.[a]	3.47	0.59	3.76	0.61	−2.25*
I was not given a chance to say what I wanted to say.[b]	1.61	0.81	1.38	0.72	—
Some members were pressured into going along with the group solution.[b]	2.86	0.90	2.43	0.81	2.35*
I liked everyone in the group.[b]	4.02	0.59	4.20	0.63	—
We worked unusually well together.[b]	3.48	0.55	3.81	0.66	−2.53**
We all agreed on the final product.[b]	4.02	0.59	4.31	0.52	−2.50**
Cold to warm impression of group[c]	4.06	0.58	4.11	0.84	—
Pleasant to unpleasant impression of group[c]	1.70	0.76	1.59	0.69	—
Friendly to unfriendly impression of group[c]	1.77	0.71	1.36	0.57	2.97**
Formal to informal impression of group[c]	3.75	0.99	3.36	1.08	—
I did not work hard on the task.[b]	2.02	0.63	1.70	0.51	2.61**
Everyone contributed to coming up with a group solution.[b]	4.27	0.54	4.27	0.54	—
Nonchalant to serious impression of group[c]	3.52	0.87	3.68	0.90	—
Organized to disorganized impression of group[c]	2.00	0.61	1.56	0.58	3.38**

Note. Only significant t values are shown.
[a] 5-point (worse to better) comparative judgment item. [b] 5-point (disagree to agree) item. [c] 5-point bi-polar adjective item.
* $p < .05$. ** $p < .01$.

agree than were other group members that they were able to say what they had wanted to say, $F(3, 40) = 4.46$, $p < .01$. Again, this difference was not obtained among conventional group members.

Discussion

The results of this study provide evidence that groups using the stepladder technique to solve a complex and novel problem produce higher quality decisions than do groups using a conventional group structure. In this section, we examine previously mentioned explanations for the observed difference between the two types of groups.

One explanation involves communication and social loafing. Stepladder group members reported working significantly harder on the task then their counterparts in conventional groups. The perception of working harder may be evidence that social loafing was effectively reduced by the communication mandate in the stepladder groups. In addition, stepladder group members reported significantly more often than conventional group members that they all agreed on the final group product. Perhaps agreement was a function of working hard and fully understanding the group outcome. Although the working-hard perception has already been addressed, the stepladder requirement that the entering member and the core group explain their solutions may have led to constant reiteration and verbalization of group members' ideas. Verbalization and reiteration increase comprehension, understanding, and retention of information (Johnson & Johnson, 1987, p. 89). Furthermore, it is plausible that careful and nonegocentric listening occurred within the groups. An entering member may have acted as a consultant or a reviewer, with all other members curious and active listeners. It was a common anecdotal report by participants that, while an entering member was presenting options, the core group would constantly ask, "Why do you say that"? This questioning of views may have led to more viable and effective information, which the group could use when making the final decision.

The second explanation involves the role of critical decision making within groups. Although critical decision making could not directly be observed in these groups, it may be inferred. The survey results regarding perceptions of the group showed that stepladder group members felt less pressure to conform than did their counterparts in the conventional groups. The perception of less pressure to conform may support our contention that social pressure would be effectively reduced because groups were not formed in their entirety until the last member joined the core group. Less pressure to conform may lead groups to freely evaluate ideas rather than actively avoid disagreements and to not allow blind conformity.

A third possible explanation concerns the structure and organization provided by the stepladder technique. Common anecdotal complaints among conventional group members were that they were not productive, things were chaotic, and time was wasted. Stepladder group members agreed more frequently than did conventional group members that they had worked unusually well together and that they were more organized. In addition, the stepladder structure calls for preliminary decisions to be reached and then made again after the presentation of the next group member. The stepladder groups were in effect continually remaking their decisions. Remaking of group decisions has been reported to have beneficial effects on group output (Maier & Hoffman, 1960).

The fourth explanation examines the role of the best member within the group. The observation that the best members in the stepladder groups reported feeling that they had had a chance to say what they wanted to say (more than any other member) suggests that, because the stepladder structure initiated communication (and the act of communicating may reveal knowledge), individual expertise was subtly made known. Perhaps the perceived recognition of an expert led the stepladder groups to allocate more time for the best member to express ideas and concerns. In short, better ideas not only were more likely to be expressed but also were more likely to be attended to and recognized as better. Air time associated with expertise, coupled with the other explanations for the stepladder technique's success, may account for the observation that stepladder groups surpassed in quality the decision of their best member 56% of the time.

Overall, the stepladder technique appears to enhance group decision-making effectiveness. In addition, participants' perceptions of the stepladder technique suggest that group members were highly satisfied with the structure, felt that everyone agreed with the group solution, felt that their solution was high in quality, and felt comfortable with the climate produced by the technique. Taken together, these positive perceptions, accompanied with increased group effectiveness, are extremely encouraging.

Future research is needed that directly assesses the viability of these explanations for the observed superiority of the stepladder groups and that examines the conditions under which the stepladder technique is more or less likely to be useful and practical. It is also important to identify what other kinds of group process and outcome variables might be enhanced by this approach.

Specifically, there may be a limit to the number of decision makers that can adequately be incorporated into the decision-making process with the stepladder technique. The stepladder technique, as employed in the present study, may work only when relatively few individuals are involved in the decision. When there are only a few people in the group, the process does not last exceedingly long; thus, it may be avoiding the point in the process at which deviant opinions may be rejected or ignored. In large groups, deviant opinions may be attended to and incorporated into the group solution early on, yet the very same deviant opinions, if they occur later in the process (because of a large group size) may pose a threat to group consensus and may be rejected or ignored. Alternatively, the stepladder technique could be modified for larger groups. In other words, larger groups may require different building structures with the constraints of only a few rungs (e.g., two members enter on each respective step instead of one).

In addition, in many organizational settings, the problem itself has not been defined. In this study, the problem was defined for the group. Does the stepladder technique facilitate high-quality decisions when the problem has not been defined? The stepladder technique may be most useful when the task (a) is definable, (b) has not been subdivided, (c) requires informa-

tion from each member and no one member contains exclusive information that results in the group waiting for that member's entry, (d) does not require simultaneous participation, and (e) is not being conducted under urgent time pressure, thus allowing for group development through multiple steps.

Finally, pre-existing power differentials among group members may impact group effectiveness. For the stepladder technique to work effectively, it may require each member to have equal status (power) or it may require that all members be assigned randomly to entry positions. Random assignment to entry positions will convince group members that no systematic factors (e.g., power differentials or expertise) influenced their entry position. Therefore, there will be no reason for members, regardless of entry position, to think that the solutions produced by the people entering before them were any better or worse than their own. Correspondingly, systematic assignment of order of entry by power or expertise may curtail the effectiveness of the stepladder technique by putting pressure on the members entering later to conform and to avoid discussing pre-existing or new ideas critically. However, even in a "power-unbalanced" stepladder group, the member entering last must present his or her ideas before hearing other members' (of greater power) ideas. Therefore, the least powerful member is still heard in power-unequal groups, whereas in conventional groups the least powerful member may never be heard.

Although much more work needs to be done concerning the stepladder technique, the preliminary findings are encouraging. Group decision making is a potentially powerful tool for making decisions, and the stepladder technique is a method for facilitating the ideal of high-quality group decisions.

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