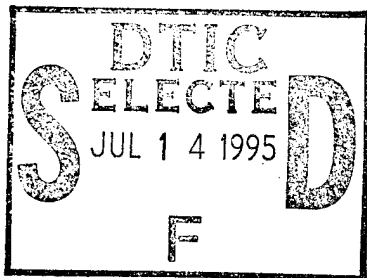


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Cognitive Resource Theory and the Utilization of the Leader's and Group Members' Technical Competence

**Susan E. Murphy, Dewey Blyth,
and Fred Fiedler**

University of Washington



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COGNITIVE RESOURCE THEORY AND THE UTILIZATION OF THE LEADER'S AND GROUP MEMBERS' TECHNICAL COMPETENCE

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COGNITIVE RESOURCE THEORY AND THE UTILIZATION OF THE LEADER'S AND GROUP MEMBERS' TECHNICAL COMPETENCE

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ABSTRACT

The belief that training leads to improved job performance is often left unquestioned. For various reasons, however, research has failed to demonstrate a consistent relationship. Two related experiments investigated the conditions under which technical training for leaders and group members contributes to group performance. The first study compared the effectiveness of decisions in groups in which the leader was (a) instructed to be either directive or nondirective and (b) given or not given a brief training period to provide task-relevant knowledge for making the required group decisions. A second study compared the performance of trained group members under directive and nondirective leaders. As hypothesized, the leader's technical knowledge or expertise contributed to group performance only if the leader was both trained and directive; group members' task-relevant knowledge contributed to group performance only if the leader was nondirective. The results are discussed in the context of Cognitive Resource Theory.

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Technical training for managers and supervisors is usually designed for the purpose of increasing the individual's competence and expertise in the expectation that this will improve the manager's and the organization's performance. It reflects the widely held belief that "competence is still the most important single factor in the leader's effectiveness" (Hollander, 1978, p. 154). Technical training is here defined as instruction that provides task-relevant knowledge (TRK) and skills needed for the performance of a specific job, e.g., teaching a shipping manager how to package a company product as against, for example, teaching business economics.

Evidence that most organizations accept this premise is found in a recent survey of management training programs and practices of 1000 large American companies (Saari, Johnson, McLaughlin and Zimmerle, 1988). Of the 611 companies that responded to the questionnaire, 77% reported programs designed to increase their managers' job-relevant skills and knowledge.

It is considerably less clear that the empirical evidence justifies training of this nature. Not one of the companies in the study by Saari, et al., reported conducting rigorous evaluations of its training programs. Most often, participants were not assigned to control conditions and training was evaluated simply by asking the trainees to give their opinion on its value. An additional problem in attempts to evaluate effects of training on managerial performance is the tendency in many private sector organizations to send their most effective managers for training as a reward, or in the belief that they will benefit more from training than managers who are marginal and may have to be derailed or discharged. It is then difficult to determine cause and effect relations between training and performance.

Review of Related Studies

The published research on the effects of technical training does indicate that leaders, considered to be technically competent are more likely to be accepted by group members, that they are more assertive, and more successful in having the groups follow their suggestions than are leaders with less training (Julian & Hollander, 1966; Price & Garland, 1981). Very few studies, however, have evaluated whether technical training for leaders and managers actually improves performance.

To investigate the relationship between technical training and leadership performance, Fiedler and his colleagues have examined the effects of technical training in a number of studies (cf. Fiedler & Garcia, 1987). Most of the studies were conducted on military personnel who participated in relatively standardized training programs and performed similar tasks under highly comparable conditions. These settings allowed the collection of reliable performance evaluations from knowledgeable superiors. Although this research used primarily military subjects, additional research by Fiedler (Fiedler & Garcia, 1987) has not found major differences between military and nonmilitary organizations performing similar tasks.

The first study (Blades & Fiedler, 1973) dealt with army dining halls which provided food service to companies of 100 to 200 men, and whose performance was evaluated by the company commander and a brigade staff officer. A second study was based on the lower leadership echelons of 9 army infantry battalions (Bons & Fiedler, 1976). The study focused on the performance and training of squad leaders who headed 10 man units, and their superiors, i.e., platoon sergeants and platoon leaders. Performance was evaluated in each case on the basis of superiors' ratings. Another study was conducted on army artillery section chiefs, each in charge of a field gun, and navy chiefs of technical maintenance shops at a Naval Air Station (Csoka & Fiedler, 1972). Again, performance evaluations for these leaders were obtained by one, and usually by two superiors. Almost all training in these studies was technical in nature. A possible exception in the data presented from the Bons and Fiedler study is training provided to platoon

leaders who are usually second lieutenants with officer training from West Point or the Reserve Officer Training Corps, and a basic officer training course.

The studies failed to show that technical training increased the performance of the leader or of the leader's group. The correlations between amount of training and rated performance are summarized in Table 1. The table indicates whether the training is general or exclusively technical in nature and whether the leader's or group's performance was rated. As can be seen, the correlations are negligible, and as often in the negative as the positive direction. In these studies, technical training appears to be unrelated to leader or group performance.

Although the findings presented above indicate no relationship between amount of training and performance, many factors can explain the lack of relationship. It is possible that a measure reflecting the absolute amount of training does not necessarily reflect the quality or applicability of the training. In other words, it may be that crude measures of training are unrelated to performance because the measures do not assess the amount of training which is directly applicable to leadership or specific technical performance. One study that explored this possibility was a well controlled laboratory experiment by Chemers, Rice, Sundstrom and Butler (1975). In the study half of the leaders of small groups were given task-relevant training, while the other half received no training. The results showed that teams led by trained leaders performed no better than did teams whose leaders had not received "technical" training. Training again was unrelated to group performance.

TABLE 1
CORRELATIONS BETWEEN TECHNICAL OR GENERAL TRAINING OF LEADERS AND
THEIR OWN PERFORMANCE OR PERFORMANCE OF THEIR GROUPS

Author(s)	Sample	Type of Training	Performance	r	n
Blades & Fiedler (1973)	Army mess stewards	Technical Food Service Training	Rating of leader	.07	48
			Rating of group	.00	48
Csoka & Fiedler (1972)	Artillery crew chiefs	Technical training Total training	Rating of crew	.17	56
			Rating of tech. skills	.07	56
Bons & Fiedler (1976)	Army squad leaders	Training - mostly technical	Rating by platoon ldrs & sgts	-.01	295
Bons & Fiedler (1976)	Army platoon sergeants	Training - mostly technical	Rating by platoon leaders/Company	-.06	87
Bons & Fiedler (1976)	Platoon leaders (2nd lieutenants)	Total training	Rating by superior officers	-.07	72

Directive Leader Behavior and Group Performance

One possible reason for the lack of relationship between the leader's technical training and leader or group performance has been suggested by Blades (1976) and has later become an important element in Cognitive Resource Theory (CRT) (Fiedler, 1986; Fiedler & Garcia, 1987). Blades pointed out that the leader's knowledge or expertise has to be communicated to the group, and that this communication typically does not take place unless the leader is directive, i.e., tells the group how to do the job and the group complies with the leader's directions.

Blades has argued that directive behavior should be seen as neither good nor bad in itself, but rather as a vehicle for communicating good or bad ideas to the group. His study of 52 army mess halls resulted in a correlation of .56 between leader intelligence and the rated performance of the mess hall when the leader was directive and had group support. Correlations were low and nonsignificant in mess halls in which the leader was nondirective or had a nonsupportive group. The correlation between months of leader training and rated performance was .25 when the leader was directive and had group support, but $-.65$ ($n=11$, $p < .05$) when the leader was nondirective and not accepted by the group (Blades & Fiedler, 1976). The latter is a particularly interesting finding: while the correlation between leader training and performance under the most favorable conditions (directive leader and supportive group) was in the positive direction, albeit nonsignificant, the corresponding correlation in nonsupportive groups with nondirective leaders was highly significant but in the negative direction (Blades, 1976, cited in Fiedler & Garcia, 1987). Thus, amount of technical training for mess stewards in this set of groups turned out to be detrimental to performance.

Directive Leader Behavior and Group Decision Acceptance

Directive behavior, however, can present two problems. Blades (1976) as well as CRT (Fiedler, 1986; Fiedler & Garcia, 1987) emphasize that the group must be willing to comply with the leader's decisions. It is important to ask, therefore, whether leaders who are directive in the management of their groups are as well accepted as those who are not directive. Various management theorists have postulated that group members are more likely to "buy into" the task if the leader is nondirective rather than directive (e.g., Likert, 1967; Locke & Schweiger, 1979; Maier, 1950; McGregor, 1960; Vroom & Yetton, 1973). These theorists also predict that members of groups with nondirective leaders will be more satisfied with the task and the outcome of the task than will subordinates of directive leaders.

According to the Path-Goal theory of leadership, directive behavior is acceptable to subordinates when a task is ambiguous because the leader provides the necessary guidance to complete the task (House & Mitchell, 1974; House & Dessler, 1974). This is of course assuming that the leader has the technical competence to provide assistance. If the leader's level of task competence does not exceed that of his or her subordinates, directive behavior will be unacceptable. We need to determine, therefore, whether decisions made by groups with directive leaders are as well accepted as those by groups with nondirective leaders, and how leader expertise moderates this relationship.

Another problem associated with directive leader behavior is that the directive leader in effect pre-empts the time and the ideas that are to be discussed and, therefore, inhibits group member participation. Maier (1963) and Blades (1976), among others, have proposed that group members cannot fully contribute to the task if the leader is directive. Vroom and Yetton's (1973) Normative Decision Model is based on a similar assumption. This model prescribes a participative style if the leader (a) lacks knowledge or (b) needs the group members to accept the decision. Path Goal Theory (House & Mitchell, 1974) postulates that leaders must be nondirective if subordinates are competent and highly trained in order to allow them to contribute to the task.

Purpose of the Study

One problem with such data as those presented in Table 1 is that they are based on correlational studies which make it difficult to deduce cause and effect. As we mentioned earlier, there may be a bias in the organization as to provide training for certain people but not others. In addition, there may well be considerable self-selection that makes the more assertive or more highly motivated individuals more likely to be selected to attend various training programs. The study by Blades and Fiedler (1973) relied on superiors' perceptions and ratings

of leader behavior. Research on leader behavior has been criticized for relying on perceptions of leader behaviors. For example, Lord (1985) found that regardless of actual leader behavior, groups that performed well rated their leaders as more considerate than groups that performed poorly. The two related studies reported here avoid these particular threats to validity. The leader's behavior and technical or task-related knowledge are experimentally manipulated in the first study.

Directive Behavior and Group Performance

Based on Blades' (1976) study as well as previous research on the contribution of leader intelligence, we expect that training will be more effective if the leader behaves in a directive rather than nondirective manner. Directive behavior will allow the leader to capitalize on his or her technical training.

Hypothesis 1a. Directive leaders who have task-relevant knowledge will have better performing groups than leaders who are nondirective, and will be more effective than leaders who did not receive training.

Hypothesis 1b. To the extent intelligence is related to task performance, directive and intelligent leaders will have better performing groups than will less intelligent leaders if the leader is directive.

Group Decision Acceptance and Perceptions of Leader Expertise

Group member's ability to recognize differential expertise has been found to be important for increasing group performance (Miner, 1984; Yetton & Bottger, 1983). A recent study by Libby, Trotman, and Zimmer, (1987) found higher performance in interacting groups who could identify their expert member. Groups that recognize an expert are able to use the knowledge given by the expert and perform better than groups in which the expert is not identified. As outlined above, Path-goal theory makes the prediction that leader competence increases the attractiveness of directive behavior. It is expected that the recognition of this competence will determine the group member's acceptance of directive leader behavior.

Hypothesis 2a. In general, members of groups in which the leader is nondirective will be more satisfied with (a) the group and (b) the solution of the problem.

Hypothesis 2b. To the extent that task-relevant competence is recognized, members of groups in which the leader has task-relevant knowledge and is directive will be more satisfied with the problem solution than groups with trained, nondirective leaders.

Contribution of Group Member Knowledge

Leader behavior and group member task-related knowledge are manipulated in the second study. We expect that nondirective leader behavior will result in more effective group performance when the group has task-relevant knowledge and the leader does not.

Hypothesis 3. Technical knowledge of group members contributes more highly to performance in groups with nondirective rather than directive leaders.

METHOD

Subjects

Psychology students, enrolled in a subject pool for course credit, were randomly assigned to 56 three- or four-person groups, with one person randomly chosen as the leader. Of the 190 subjects 112 were females; 45 groups were of mixed gender; 31 leaders were female and 25 were male. Differences in performance of groups with male or female leaders, and with three or four group members were nonsignificant.

Design

Experimental manipulation of leader behavior and task-relevant information resulted in a 2 (Directive Leader/Nondirective Leader) x 2 (High task-relevant knowledge (TRK)/Low TRK) design with four experimental conditions of 14 groups each: 1) Directive, High TRK Leader, 2) Nondirective, High TRK Leader, 3) Directive, Low TRK Leader, and 4) Nondirective, Low TRK Leader.

Task

Groups engaged in the "Desert Survival Problem" (Lafferty and Pond, 1974) which tells participants that they have crash-landed in a desert area in the southwestern United States in mid-August. All but 15 items of equipment have been destroyed and these must be ranked in declining order of survival value. The groups' rankings are compared with those of survival experts.

Most participants tend to become very involved in the exercise, and motivation is high. Without training on the task, subjects, working by themselves, tend to perform poorly. The Desert Survival Problem requires participants not only to evaluate possible solutions, but also to decide whether (correctly) to remain at the crash site or (incorrectly) hike toward a community about 70 miles away. Some groups overlook this important decision completely, either because they lack knowledge or because of ineffective group interactions (Lafferty and Pond, 1974). The decision to move is crucial and can severely reduce the group's presumed chances of survival. It also affects the potential value of several equipment items which must be rank ordered by the participants. (In this study no groups chose to leave the crash site.)

Procedure

Manipulation Phase: After a brief introduction to the experiment, participants randomly assigned to leadership positions were taken to a separate room ostensibly to receive directions for the task and the group process that were to take place in another room. Those assigned to the directive condition were given written instructions to direct the group's activities and control the discussion. The instructions were as follows:

"A number of approaches to leading a group in a task such as the Desert Survival Problem can be taken. Some leaders prefer to keep a low profile, permitting the group members to contribute a great deal to the group discussion and to the solution. However, for the purposes of this exercise, we would like you to take the opposite approach. You are to direct every aspect of your group's activities from the beginning to the end of the session. You are encouraged to argue forcibly for your own opinions and ideas, even if it is at the expense of receiving input from your group members. You decide how your group will proceed as it works toward a solution to the problem. Additionally, you should control the activities and discussion of the group throughout the exercises. Your

group members may or may not know more about desert survival than you. If they question your approach, simply explain to them that you are in charge and that you will decide how the group will conduct itself."

Leaders in the non-directive condition were instructed to exert minimal influence and to refrain from strongly arguing for their positions, but to concentrate on keeping track of time and recording the group solution. Their instruction were as follows:

"There are a number of approaches which can be taken when leading a group in tasks such as the Desert Survival Task. Some leaders prefer to dominate and control their groups, allowing the group members little input into the group solution. We would like for you to take the opposite approach, that is, you are to exert minimal influence over the group process. Your role is to listen to the others. They may or may not know more about the task than you do, but it is important that the group solution represents a product of the group's efforts. Your primary role is to record the solution at which you group arrives and to keep track of time, keeping a low profile through the session. You may provide emotional support and encouragement if you so desire."

Half the leaders in the directive condition and half in the nondirective conditions also received about 10 minutes of training on methods which would enhance their chances of surviving in the desert. This was the manipulation of task-relevant knowledge (TRK). The training consisted of three pages of information about the usefulness of the various items for survival in the desert. For instance, trained leaders were told that the cosmetic mirror could be used for signaling purposes. Although all the information was useful, it did not indicate the relative importance of a particular item compared to all the others. In other words, the subjects were not given the solution. Group leaders receiving no training read unrelated material.

Pre-test Phase: All subjects were given 8 minutes to read the Desert Survival Problem and rank the 15 survival items in order of importance. When asked, none of the subjects indicated that he or she was familiar with the task. The subjects' ranking, when compared to the ranking of experts, provided a pre-test to indicate their ability to perform the task alone. Leaders who had received task relevant information completed the ranking after receiving their training. A manipulation check showed that leaders who were given task-relevant information performed significantly better on the pre-test than leaders who did not receive training ($t(51 \text{ df})=8.82$, $p<.001$).

Group Decision-Making Phase: After the group was assembled, the leaders introduced themselves to group members, explained the task, and indicated that the group had 20 minutes in which to complete it. Leaders were instructed not to tell the group members whether they had received training on the task. Experimenters were told to report if this occurred. The data for one group whose leader alluded to some knowledge were discarded. After reaching consensus, or when time was called, the leader checked that all group members had recorded the same group solution and handed the rankings to the experimenter.

Post-test Phase: After completing the task, group members had 5 additional minutes for re-ranking the 15 survival items, and thus indicating the extent to which they agreed or disagreed with the group decision. The group members had a copy of the group's final ranking from which they could make any changes. Group members and leaders then completed slightly different versions of a post-session questionnaire on which they indicated (a) on two seven-point Likert scales their satisfaction with the group solution and agreement with the final outcome ("solution agreement", internal consistency, coefficient alpha = .82); (b) group members' perception of the leader's knowledge on a single seven-point Likert scale, and (c) the leader-member relations (LMR) in the group on seven five-point Likert scales (Fiedler & Chemers, 1984; internal

consistency, coefficient alpha = .90). Finally, (d) two five-point Likert items assessing leader behavior scale assessing directive and participative behavior served as a check of the leader behavior manipulation. According to group members, leaders assigned to the directive condition were seen as significantly more directing and controlling than those assigned to the non-directive condition ($t(51\text{ df})=5.32, p<.001$) and significantly less participative ($t(51\text{ df})=-3.16, p<.01$).

Since the Desert Survival task required resourcefulness as well as the ability to utilize knowledge acquired by training, it seemed important to determine the participants' abilities on these characteristics. Because other more extensive measures of intelligence were not available for the sample, a 15-item version of Horn's Fluid (Gf) intelligence and a 24-item version of the Crystallized (Gc) intelligence scale were used. These scales have been used in previous studies and are found to relate to task performance for certain types of tasks (e.g., Fiedler, Potter, & McGuire, 1988; Locklear, 1988).

The fluid intelligence test consists of letter-sequence puzzles and the crystallized intelligence test contains synonyms and word analogies. Fluid intelligence is associated with one's ability to solve ambiguous, unstructured problems, while crystallized intelligence measures what one has learned over time and is related to level of education (Horn, 1968). In addition, it was important to determine whether performance on the Desert Survival task was simply a function of intelligence. The latter clearly was not the case: the pre-test of ranking the survival items correlated -.07 and .14 (n.s.) with fluid and crystallized intelligence, respectively, indicating that the ability to rank the survival items correctly was not a function of intellectual ability.

Dependent Variables

The "correct" solution to the Desert Survival Problem was based on rankings by a panel of experts from the Desert Branch of the U.S. Air Force Arctic, Desert, and Tropic Information Center. Each group's performance score was the sum of the absolute differences between the ranking of items for the correct solution and the item rankings of the group's solution, with scores ranging from 0 to 112. A low score indicates good performance.

Acceptance of the decision was defined as the sum of the absolute differences between the group solution and the individual's post-session ranking. To the extent to which an individual agreed with the group solution his or her post-session ranking would be similar to that of the group. This method of calculation has been used in a number of studies to indicate solution acceptance (cf. Jago, Ettling, & Vroom, 1985).

RESULTS

Leader Directiveness, Task-Relevant Knowledge, and Performance

Hypothesis 1 predicts that groups with trained and directive leaders will perform better than groups with leaders who were not trained or told to be nondirective. The results, here shown as mean differences between group ratings, support this hypothesis (Table 2). A 2 x 2 analysis of variance shows that groups led by directive and trained leaders outperformed groups led by nondirective and by untrained leaders. Even more importantly in the context of the present study, the interaction between leader training and leader directiveness also was highly significant ($F=15.72$, with 1 & 52 df, $p < .001$).

TABLE 2
MEAN GROUP PERFORMANCE BY
TRAINING AND DIRECTIVENESS CONDITION

	Leader Behavior		Leader Behavior	
	Directive	Non-directive	Directive	Non-Directive
Condition	1	2	3	4
Mean	33.28	56.93	68.93	64.85
S.D.	16.86	11.23	13.00	10.34
	n=14	n=14	n=14	n=14

Lower scores indicate higher performance

Overall mean was 56.75 with a range of 10 to 92 and a standard deviation of 19.09.

As shown in Table 3, the manipulation of leader task-relevant knowledge accounted for the greatest amount of variance in performance, followed by the interaction between leader training and leader directiveness. Together, leader training, leader directiveness, and the interaction of these two conditions accounted for 54 percent of the variance in performance, thus supporting Hypothesis 1a.

TABLE 3
ANALYSIS OF VARIANCE FOR GROUP PERFORMANCE
AND DECISION ACCEPTANCE

	PERFORMANCE		DECISION ACCEPTANCE	
	F	ω^2	F	ω^2
Task-Relevant Training (A)	38.36**	.33	.03	.00
Directive Behavior (B)	7.84**	.07	7.32*	.12
A X B	15.72**	.14	.23	.00

* $p < .05$

** $p < .01$

Leader Directiveness, Task-Relevant Knowledge, and Agreement with the Task Decision

Nondirective leader behavior presumably increases group member satisfaction, commitment, motivation, and acceptance of the leader's directions (e.g., Sashkin, 1984; Vroom & Yetton, 1971). The literature, as well as the present study supports these predictions. Members in groups with nondirective leaders reported relatively more satisfaction and also more

agreement with the group's solution ($F=7.321$ ($df=1,51$), $p<.01$), as indicated by fewer changes of the group solution by individual group members, and by significantly higher leader-member relations in groups of nondirective than directive leaders ($F=19.016$ ($df=1,51$), $p<.001$). (See Table 3 and 4).

TABLE 4
MEANS AND STANDARD DEVIATIONS FOR GROUP DECISION ACCEPTANCE
BY TRAINING AND DIRECTIVENESS CONDITION

	TASK-RELEVANT KNOWLEDGE (TRAINING)		NO TASK-RELEVANT KNOWLEDGE (NO TRAINING)	
	Leader Behavior Directive	Non-directive	Leader Behavior Directive	Non-Directive
Mean	21.93	8.79	20.67	11.48
S.D.	21.96	7.61	17.06	11.08
	n=14	n=14	n=14	n=14

* Lower scores indicate higher agreement

Group members' perceptions of the leaders' task-relevant knowledge was assessed with one 7-point scale on which group members rated the leader. The overall average was 3.84 ($s.d.=1.28$) and did not differ significantly by condition. That is, leaders in the task-relevant knowledge condition were not seen as having more TRK than those not given training. In addition, acceptance of the group decision was uncorrelated with group performance ($r=-.13$, $n=134$). (As will be discussed later, the nature of the task may not facilitate the recognition of an individual's task expertise.) Although the group members' perceptions of the leader's TRK did not differ by experimental condition, their perceptions were hypothesized to influence decision acceptance. Table 5 indicates that a higher perceived level of leader knowledge was correlated with greater acceptance of the group decision.

TABLE 5
CORRELATION BETWEEN PERCEIVED EXPERTISE
AND DECISION ACCEPTANCE

TASK-RELEVANT KNOWLEDGE		NO TASK-RELEVANT KNOWLEDGE	
Leader Behavior Directive	Non-directive	Leader Behavior Directive	Non-Directive
.39*	.15	.62*	.27
n=33	n=34	n=34	n=34

$r=.62$ versus $.27$ $z=1.76$ n.s. $p>.05$ two-tailed.
 $r=.39$ versus $.15$ $z=1.03$ n.s. $p>.05$ two-tailed.

Leader's Fluid Intelligence, Crystallized Intelligence, and Task Ability

The possible contribution of intellectual abilities and task ability (indicated by the pre-test of the Desert Survival Task) to task performance is of interest for two reasons. First, given the strong experimental manipulations, we are able to examine whether intellectual abilities will still contribute more to performance if the leader is directive than if the leader is nondirective. Second, we can test the alternative hypothesis that "training" and TRK in this study simply reflect the leader's intellectual ability, that is, that an intelligent leader could have performed equally well without the benefit of training.

As will be recalled, we obtained measures of fluid and crystallized intelligence, as well as task-relevant knowledge reflected by the pre-test for both leaders and group members. These measures were correlated with group performance and are presented in Table 6.

TABLE 6
CORRELATIONS BETWEEN COGNITIVE ABILITIES AND
PERFORMANCE FOR LEADERS AND GROUP MEMBERS

	TASK-RELEVANT KNOWLEDGE		NO TASK-RELEVANT KNOWLEDGE	
	Leader Behavior Directive	Non-directive	Leader Behavior Directive	Non-Directive
Leader Gc	.17	-.16	.27	.34
Leader Gf	.37	.35	-.08	.14
Leader Pretest	.66**	.04	.85***	-.12
Avg. Member Gc	-.20	.51*	.08	.83***
Avg. Member Gf	-.09	.07	.57*	.71**
Avg. Member Pretest	-.06	.19	-.14	.26
	n=14	n=14	n=14	n=14

Gc=Crystallized Intelligence

Gf=Fluid Intelligence

* p<.05

** p<.01

*** p<.001

Leaders' Fluid intelligence correlated -.07 (n=27, n.s.) with initial pre-test performance in conditions in which the leader received no training. Leaders' Crystallized intelligence correlated .14 (n=27, n.s.) under the same conditions.

For groups with directive leaders, pre-task ability (as measured by the leader's individual pre-test scores), correlated highly with group performance regardless of whether the leader had been given task-relevant training. Specifically, in conditions in which the leader received training and was directive, the correlation between his or her pre-task ability score and group performance was .66. In conditions in which the leader received no training but was told to behave directly, the correlation between his or her pre-task ability score and group performance was .85. In other words, even when the leader received no training, the knowledge he or she had about the task correlated highly with group performance when the leader was directive. Directive leaders who did not have training used what knowledge they had to direct the group even if this knowledge did not improve group performance. These correlations differed significantly from the corresponding correlations for groups with nondirective leaders (.04 and -.12). (The differences between $r=.66$ versus .04 and $.85$ versus $-.12$ are significant $z=1.76$, $p<.05$ and $z=2.28$, $p<.01$ respectively.) This finding again supports the hypothesis that a good understanding of the task contributed to performance only if the leader then communicated this knowledge to the group by directive behavior.

The leader's fluid intelligence correlated .36 ($n=28$ $p<.05$) with group performance of trained leaders, regardless of their directiveness. Crystallized intelligence was not significantly correlated with performance ($r=.29$, $n=28$, $p>.05$) for untrained leaders.

The Contribution of Group Member Intelligence and Task Ability to Performance

McGregor (1960), Maier (1950), Vroom & Yetton (1973) and Blades (1986), among others, predict that group members cannot contribute to performance unless the leader, by being nondirective, provides an accepting climate. As one test of this proposition average group members' pre-test scores, as well as average group fluid and crystallized intelligence scores, were correlated with group performance in each of the four experimental conditions. The results for group members are also presented in Table 6 to permit easy comparison with the corresponding results obtained for leaders.

Members' crystallized intelligence, i.e., the ability to profit from such sources as books or school, did not correlate with performance in groups in which the leader was directive. However, group member crystallized intelligence did correlate highly when the leader was non-directive across both task-relevant knowledge conditions ($r=.51$ and $r=.83$ respectively). In contrast, the group members' fluid intelligence correlated with performance only in groups of untrained leaders. The group members' pre-test scores did not correlate with performance under any of the experimental conditions.

STUDY 2

Study 1 suggested that the leader's task-relevant knowledge contributes to performance only if the leader is directive. The main hypothesis of the second study is that the group members' training contributes to performance only if the leader is nondirective.

Subjects

Subjects were 48 male and 13 female members of the New York National Guard who attended a two-week noncommissioned officers course. The subjects' mean age was 34 years, and their civilian jobs ranged from high school teacher to first-line supervisors and middle managers. These subjects were randomly assigned to 19 three-person groups and one four-person group, with one member of each group randomly chosen as leader. A job satisfaction questionnaire was administered at the end of the task but time limitations and limitations imposed by the organization precluded the collection of other data.

Design and Procedure

All group members, except the leader, were given task-relevant training. Because several subjects in this sample knew the Desert Survival Task, the equivalent "Mountain Survival Task" was used. The expert rating was provided by experts associated with the Institute for Survival Education in Seattle.

"Training" again consisted of information that participants were given to read about the task. However, in this study, training gave relevant information about the survival value of half the items to half of the members of each group and on the survival value of the other items to the remaining group members. As a group, the members, therefore, had information about the usefulness of each of the survival items. Leaders read through the task but were not given further training or guidance. Performance was again defined by the similarity with which 15 survival items were ranked by the group and the acknowledged experts.

As in the first study, half the leaders were instructed to be directive, the other half nondirective. A manipulation check indicated that the group members had significantly more "expertise" than did the untrained leaders. A manipulation check based on member ratings confirmed that the directiveness manipulation had been effective ($t(18) = 4.06, p < .001$).

RESULTS

The main hypothesis of this study was that group member training contributes more highly under nondirective than directive leaders. In addition, we tested whether group member satisfaction was again higher under nondirective than directive leaders. Both hypotheses were supported (Table 7). Groups with non-directive leaders performed significantly better than groups with directive leaders. Group members who received training were unable to contribute to group performance when their leader was directive. Also, as expected, group members reported significantly higher levels of satisfaction when their leader was non-directive.

TABLE 7

PERFORMANCE AND SATISFACTION OF GROUPS WITH DIRECTIVE OR NONDIRECTIVE LEADERS

	LEADER DIRECTIVENESS		S.D.	p
	High	Low		
PERFORMANCE	60.2	39.4	2.66	.01
SATISFACTION	4.0	5.0	1.99	.05
	n=10	n=10		

Note: Low score indicates high agreement with experts, i.e., high performance.

DISCUSSION

The two main results of these studies show that the leader's technical training benefitted group performance only when the leader was directive and thus communicated his or her knowledge and that the group members' technical training benefitted performance only when the leader was nondirective. Post hoc, these findings are not unexpected. But there are some surprises which make our findings interesting.

First, many eminent theorists and researchers have argued that nondirective leadership improves performance by enabling and encouraging group members to contribute to the group task. Very few have pointed out that leaders cannot effectively capitalize on their own technical knowledge and expertise unless they are directive. We also know of no technical training programs that stress the need of leaders to be directive in guiding their groups. It is, in fact, startling how little effect the nondirective leader's task-relevant training had on performance. Groups with trained, nondirective leaders outperformed groups with untrained, nondirective leaders by an average of only 9.96 points. However, the performance of groups with trained leaders who were directive was better than that of trained, nondirective leaders by an average of 23.65 points, and better than untrained leaders by no less than 33.61 points. Directive behavior on the part of the trained leader thus led to substantially higher group performance than did the other conditions.

Second, previous studies (e.g., Blades & Fiedler, 1976) have shown that the effective contribution of the leader's other cognitive resources, such as intellectual abilities, requires the leader to be directive. The results of the first study found that neither the leader's crystallized nor fluid intelligence correlated highly with group performance under any of the four experimental conditions. This is not surprising given the low initial correlations of these two types of intelligence with individual pre-test measures of ability (.07 for fluid and -.14 for crystallized intelligence). A recent study by Vecchio (1990) reports similar findings in an experiment using the NASA Moon Survival problem. Although Vecchio interprets his findings as lack of support for this proposition of the cognitive resource model, we do not share his conclusion. As pointed out in Hypothesis 1b, the leader's intelligence will be related to group performance when he is directive to the extent that intelligence is related to task performance. A better measure of the leader's cognitive resources in the present studies is the knowledge the leader has about the task.

Group Member Contributions

The first study found that the group members' crystallized intelligence contributed to group performance only when the leader was nondirective. The second study found that group member's task ability contributed only when the leader was nondirective. These findings are consistent with the predictions of Blades' model and CRT (Fiedler & Garcia, 1987).

The significant correlations between the members' crystallized intelligence and performance in groups with nondirective leaders could suggest that this form of intelligence, acquired from school and other sources be applied to the task in an interactive group. It is also possible that the group interaction process, facilitated by nondirective leaders, allowed group members to draw on their own past experiences, as well as trigger idea generation among other group members.

The group members' fluid intelligence appeared to have been useful only when the leader was untrained and unsure of his or her ideas, therefore, relatively open to novel suggestions and ideas, even when told to be directive. Group members high in fluid intelligence may have been able to influence the group's performance even when the untrained leader was directive. When the leader had task-relevant knowledge, the directive leader controlled the group process and group member fluid intelligence was not helpful. Needless to say, these interpretations require further study.

The data confirmed findings of previous research that group members tend to be more satisfied and more supportive of nondirective than directive leaders, and that performance is not affected by member satisfaction and acceptance of the leader. We also supported previous research that group members were more satisfied with leaders whom they perceived as having task-relevant information or abilities.

Recognition of Leader and Group Member Task Expertise

Leaders did not recognize group members' expertise in Study 2. Likewise in Study 1, group members did not recognize the leaders' expertise. That is, trained leaders were not seen by members as more knowledgeable than untrained leaders indicating that they were unable to judge accurately whether their leader had task-relevant knowledge. This finding has important theoretical implications for our understanding of such concepts as Hollander's "idiosyncrasy credit" (1958) which is based on the notion that leaders will be more highly accepted and esteemed if they have task-relevant abilities and competence. Our studies suggest that the ability of group members and leaders to recognize actual competence is limited in this type of situation with these particular types of tasks, even though "training" or expertise was specifically related to the task.

Research by Libby, et al., (1987) concludes that the ability to recognize expertise may indeed depend on the type of task. In Study 1 the strong positive correlation between the degree of decision acceptance and perceived expertise of the leader indicates that group members agreed with decisions made by directive leaders only when the leaders were perceived to possess task knowledge. However, it is difficult to determine cause and effect in the relationship between perceptions of leader expertise and decision acceptance. Rather than perceptions of leader expertise determining decision acceptance, it may be the case that the group member's level of decision acceptance determined their subsequent rating of leader expertise.

Before drawing additional conclusions we need to address limitations that are often associated with laboratory studies. Although, the subjects used in Study 1 were all undergraduate students, the subjects in Study 2 from the National Guard were older and had more experience in work-related group interactions. Even though the use of the "Desert Survival" and "Mountain Survival" tasks may present subjects with artificial situations, as has been noted elsewhere (cf. Bottger & Yetton, 1987), the problem solving and group interaction aspects of the problem are similar to those that are characteristic of many ad hoc groups solving managerial problems. Although, the training given to group leaders and members was considerably shorter and less intensive than technical training given to managers and technical personnel in real-life organizations, the results of the studies show that even this brief training session affected group performance. And in the same manner, the manipulation of leader behavior may have presented groups with behavior more extreme than that found in most leadership situations, but it provided a means for controlling leader behavior to test important hypotheses. While the results of the present studies are consistent with those obtained in military and civilian organizations in previous studies (Blades & Fiedler, 1976; Blades, 1986), parallel research in real-life situations is essential before we draw definite conclusions.

Implications

Enormous amounts of money and personnel resources are invested annually in management and technical training. These are wasted unless they contribute to organizational performance. The training literature has long been concerned with the transfer of training (cf. Baldwin & Ford, 1988) which is defined as the application of skills and abilities learned in the training session to the eventual work place or to a similar, yet different task. A recent review by Goldstein and Musicante (1987) identified a number of factors underlying successful transfer from the learning situation to the job. These included the similarity between the physical and psychological factors in the training environment to the environment in which the trainee is expected to work, the degree to which the training program fits such trainee characteristics as age, ability, and the willingness to learn; and finally, whether the desired behaviors will be rewarded or reinforced in the work place.

The present study along with others in our research program suggests that trained and/or technically competent leaders must be directive so that their task-relevant skills and knowledge can be effectively utilized by the group; leaders must be nondirective if the group members possess these skills and knowledge.

The considerable differences in the utilization of leader and group member training which we obtained merely by telling leaders to be directive or nondirective indicate that we must pay more attention to the conditions under which training can be transferred and utilized. We need research not only on how to identify an individual's abilities and skills but also on how to develop appropriate organizational settings for the effective utilization of these abilities and skills. This further step is likely to improve organizational performance by quantum leaps rather than merely a few degrees.

REFERENCES

- Baldwin, T.T. & Ford, J.K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology*, 41, 63-105.
- Bass, B.M. (1981). *Stogdill's handbook of leadership*. New York: The Free Press.
- Blades, J.W. (1976). *The influence of intelligence, task ability, and motivation on group performance*. Unpublished doctoral dissertation. University of Washington, Seattle.
- Blades, J.W. (1986). *Rules for leadership: Improving unit performance*. Washington: National Defense University Press.
- Blades, J.W. & Fiedler, F.E. (1973). *The influence of intelligence, task ability, and motivation on group performance*. (Organizational Research Tech. Rep. 76-78). Seattle: University of Washington.
- Bons, P.M. & Fiedler, F.E. (1976). The effects of changes in command environment on the behavior of relationship- and task-motivated leaders. *Administrative Science Quarterly*, 21, 453-473.
- Chemers, M.M., Rice, R.W., Sundstrom, E., & Butler, W. (1975). Leader esteem for the least preferred co-worker scale, training, and effectiveness: An experimental examination. *Journal of Personality and Social Psychology*, 31, 401-409.
- Csoka, L.S., & Fiedler, F.E. (1972). The effect of military leadership training: A test of the contingency model. *Organizational Behavior and Human Performance*, 8, 395-407.
- Fiedler, F.E. (1967). *A theory of leadership effectiveness*. New York: McGraw-Hill.
- Fiedler, F.E. (1986). The contribution of cognitive resources to leadership performance. *Journal of Applied Social Psychology*, 16, 532-548.
- Fiedler, F.E. & Chemers, M.M. (1984). *Improving leadership effectiveness: The leader-match concept* (2nd ed.). New York: Wiley.
- Fiedler, F.E. & Garcia, J.E. (1987). *New approaches to effective leadership*. New York: Wiley & Sons.
- Fiedler, F.E. Potter, E.H. & McGuire, M. (1988). *Stress and effective leadership decisions*. (Organizational Research Tech. Report 88-3.) Seattle: University of Washington.
- Fiedler, F.E., Potter, E.H., III, Zais, M.M., & Knowlton, W.A., Jr., (1979). Organizational stress and the use of misuse of managerial intelligence and experience. *Journal of Applied Psychology*, 64, 635-647.
- Goldstein, I.L. & Muscante, G.R. (1987). The applicability of a training transfer model to issues concerning rater training. In E. Locke (Ed.), *Generalizing from Laboratory to Field Settings*, Boston: Lexington Books.
- Havron, M.D. & McGrath, J.E. (1961). The contribution of the leader to the effectiveness of small military groups. In L. Pertullo & B.M. Bass (Ed.), *Leadership and interpersonal behavior*, New York: Holt, Rinehart & Winston.

- Hollander, E.P. (1978). *Leadership dynamics: A practical guide to effective relationships*. New York: Free Press.
- Horn, J.L. (1968). Organization of abilities and the development of intelligence. *Psychological Review*, 75, 242-259.
- House, R.J. & Mitchell, T.R. (1974). Path-goal theory of leadership. *Journal of Contemporary Business*, 5, 81-94.
- Jago, A.G., Ettling, J.T., & Vroom, V.H. (1985). Validating a revision to the Vroom/Yetton model: first evidence. *Academy of Management Proceedings*, San Diego, August 11-14.
- Julian, J.W., & Hollander, E.P. (1966). *A study of some role dimensions of leader follower relations*. Buffalo State University of New York, Technical Report No. 1.
- Kerr, S. & Schriesheim, C.A., Murphy, C.J., & Stogill, R.M. (1974). Toward a contingency theory of leadership based upon the consideration and initiating structure literature. *Organizational Behavior & Human Performance*, 12, 62-82.
- Korman, A.K. (1966). Consideration, initiating structure and organizational criteria. *Personnel Psychology*, 18, 349-360.
- Lafferty, J.C. & Pond, A.W. (1974). *The desert survival problem*. Plymouth, Michigan: Human Synergistics, Inc.
- Lewin, K., Lippitt, R. & Whites, R.K. (1939). Patterns of aggressive behavior in experimentally created social climates. *Journal of Social Psychology*, 10, 271-301.
- Libby, R., Trotman, K.T., and Zimmer, I. (1987). Member variation, recognition of expertise, and group performance. *Journal of Applied Psychology*, 72, 81-87.
- Likert, R. (1967). *The human organization*. New York: McGraw-Hill.
- Locke, E.A., Schweiger, D.M. (1979). Participation in decision making: One more look. In B. Stae (Ed.), *Research in Organizational Behavior*, JAI Press.
- Locklear, J. C. (1988). *The effects of individual intelligence and organizational experience on pre-decisional information acquisition*. Unpublished masters thesis, University of Washington, Seattle.
- Lord, R.G. (1985). An information processing approach to social perceptions, leadership, and behavioral measurement in organizations. In L.L. Cummings and B.M. Staw (eds.) *Research in Organizational Behavior*, 7, Greenwich, CT: JAI Press.
- McGregor, D. (1960). *The human side of enterprise*. New York: McGraw Hill.
- McKechnie, J. L. (Ed.) (1986) Webster's New Unabridged Dictionary of the English Language, (2nd Edition). Cleveland: World Publishing Co.
- Maier, N.R.F. (1950). The quality of group decisions as influenced by the discussion leader. *Human Relations* 3, 155-174.
- Maier, N.R.F. (1963). *Problem-solving discussions and conferences: Leadership methods and skills*. New York: McGraw-Hill.

- Miner, F.C. (1984). Groups versus individual decision making: an investigation of performance measures, decision strategies, and process losses/gains. *Organizational Behavior and Human Performance*, 33, 112-124.
- Miner, J.B. (1978). Twenty years of research on role motivation theory of managerial effectiveness. *Personnel Psychology*, 31, 739-760.
- Price, K.H. & Garland, H. (1981). Compliance with a leader's suggestions as a function of perceived leader/member competence and potential reciprocity. *Journal of Applied Psychology*, 66, 329-336.
- Saari, L.M., Johnson, T.R., McLaughlin, S.D., & Zimmerle, D.M. (1988). A survey of management and education practices in U.S. Companies. *Personnel Psychology*, 41, 731-743.
- Sashkin, M. (1984). Participative management as an ethical imperative. *Organizational Dynamics*, 12, 4-22.
- Vecchio, R.P. (1990). Theoretical and empirical examination of cognitive resource theory. *Journal of Applied Psychology*, 75, 141-147.
- Vroom, V., & Yetton, P. (1973). *Leadership and decision-making*. Pittsburgh: University of Pittsburgh Press.
- Yetton, P., & Bottger, P. (1983). The relationship amongst group size, member ability, decision schemes, and performance. *Organizational Behavior and Human Performance*, 32, 145-159.