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TEAMS IN ORGANIZATIONS: Recent Research on Performance and Effectiveness

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ABSTRACT

This review examines recent research on groups and teams, giving special emphasis to research investigating factors that influence the effectiveness of teams at work in organizations. Several performance-relevant factors are considered, including group composition, cohesiveness, and motivation, although certain topics (e.g. composition) have been more actively researched than others in recent years and so are addressed in greater depth. Also actively researched are certain types of teams, including flight crews, computer-supported groups, and various forms of autonomous work groups. Evidence on basic processes in and the performance effectiveness of such groups is reviewed. Also reviewed are findings from studies of organizational redesign involving the implementation of teams. Findings from these studies provide some of the strongest support for the value of teams to organizational effectiveness. The review concludes by briefly considering selected open questions and emerging directions in group research.

CONTENTS

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INTRODUCTION

Scope and Objectives

For more than a decade now, psychology has enjoyed a rekindled interest in groups and teams. Chapters in previous *Annual Review of Psychology* volumes have considered group research (e.g. Levine & Moreland 1990) and organizational behavior (e.g. Wilpert 1995), but this chapter is unique because of its special focus on team performance in organizational contexts, especially in work organizations.

The literature reviewed considers, among other emphases, research conducted in organizational settings with groups or teams that must meet the demands of producing goods or delivering services. Although we review some research conducted in other than organizational settings, we emphasize studies in which the dependent variables were clearly indicative of performance effectiveness rather than studies on intragroup or interpersonal processes in groups (e.g. studies of conformity, opinion change, conflict). We also include studies of interventions made to test the efficacy of techniques intended to improve team effectiveness. Such interventions may be targeted at individual team members (e.g. enhancing member skills that are important to team performance), at teams as performing units (e.g. team development interventions), or at the organizations in which teams work. Thus, research on larger-scale organizational change efforts of which the implementation or enhancement of teams are one part of an overall change strategy is included. Lastly, we emphasize research in the 1990s, though we do refer to earlier works.

Definitional Struggles

WORK GROUP/TEAM What is a work group? A variety of definitions have been offered (Guzzo & Shea 1992), but one we adopt owes its origins to the work of Alderfer (1977) and Hackman (1987). A "work group" is made up of individuals who see themselves and who are seen by others as a social entity, who are interdependent because of the tasks they perform as members of a group, who

are embedded in one or more larger social systems (e.g. community, organization), and who perform tasks that affect others (such as customers or coworkers).

"Team" has largely replaced "group" in the argot of organizational psychology. Is this a mere matter of wording or are there substantive differences between groups and teams? For many, "team" connotes more than "group." Katzenbach & Smith (1993), for example, assert that groups become teams when they develop a sense of shared commitment and strive for synergy among members. The definition of work groups presented above, we believe, accommodates the uses of the many labels for teams and groups, including empowered teams, autonomous work groups, semi-autonomous work groups, self-managing teams, self-determining teams, self-designing teams, crews, cross-functional teams, quality circles, project teams, task forces, emergency response teams, and committees—a list that represents, but does not exhaust, available labels. Consequently, we use the labels "team" and "group" interchangeably in this review, recognizing that there may be degrees of difference, rather than fundamental divergences, in the meanings implied by these terms. We use the terms interchangeably as a convenience. The word "group" predominates in the research literature—intergroup relations, group incentives, group dynamics—and though it uses "group" as its root word, we believe the literature has great relevance for understanding virtually all forms of teams in organizations, too.

EFFECTIVENESS There is no singular, uniform measure of performance effectiveness for groups. We prefer to define it broadly, as have Hackman (1987) and Sundstrom et al (1990). Accordingly, effectiveness in groups is indicated by (*a*) group-produced outputs (quantity or quality, speed, customer satisfaction, and so on), (*b*) the consequences a group has for its members, or (*c*) the enhancement of a team's capability to perform effectively in the future. Research that assesses one or more of these three aspects of effectiveness is of primary interest in this review.

Framework for the Review

We begin with recent research on several long-standing issues relevant to work-group effectiveness, including team cohesiveness, team composition and performance, leadership, motivation, and group goals. They are generic issues in the sense that they pertain to almost all teams doing almost all kinds of work. Although not the only performance-relevant research topics, they are the ones most actively investigated in recent years.

We then consider research on the performance of different kinds of groups, including cockpit crews and electronically mediated groups, as well as groups created to solve problems (quality circles, task forces) and autonomous work groups. The next section explicitly addresses teams and the organizational

systems in which they are embedded and focuses on the interconnections between team and organization.

The final section offers selected conclusions and flags open questions and new directions for future research. The section concludes with a brief discussion of points of leverage for effecting change in teams.

NEW LOOKS AT LONG-STANDING ISSUES IN GROUP PERFORMANCE

Cohesiveness

Reviews of cohesiveness research have appeared in recent years (e.g. Evans & Dion 1991, Guzzo & Shea 1992). The former review found a substantial positive association between cohesion and performance while the latter offered a more qualified conclusion. Smith et al (1994) report a positive correlation between a cohesiveness-like measure of top management teams in small high-technology firms and firm financial performance. Zaccarro et al (1995) reported that highly task-cohesive military teams under high temporal urgency performed as well on a decision task as did either high task-cohesive or low task-cohesive teams under low temporal urgency, suggesting that task cohesion can improve team decision making under time pressure. The topic of cohesiveness is still very much an unsettled concern in the literature. It is certainly related to issues of familiarity, which are discussed at other points in the chapter.

Group Composition

Group composition refers to the nature and attributes of group members, and it is one of the most frequently studied group design variables. Most of the empirical research on composition and work-group performance in recent years has investigated variables associated with team effectiveness without intervening or experimenting to affect those variables. The typical model of study has been to assess the performance of existing groups or teams in organizations over time and to relate that performance to measured aspects of group composition.

Other studies investigated group composition as one of several possible design variables for groups. Group design refers to issues of staffing (who is in the group, what the group size should be), specifying the group's task and members' roles, and creating organizational support systems (e.g. training opportunities) for groups. Studies conducted with teams in organizational settings are of particular interest here.

One study that related team effectiveness to composition and other potential design variables was reported by Campion et al (1993). They studied 80 work

groups in a financial services firm and found broad evidence of relationships between effectiveness and 19 design variables clustered into five categories: team job design (e.g. amount of self-management in the team), interdependence among team members, composition (especially the heterogeneity of members), intragroup processes, and contextual factors (e.g. managerial support). Campion et al found team size to be positively related to effectiveness and found heterogeneity of members' background and expertise to be unrelated or negatively related to effectiveness, depending on the specific criterion measure.

Another study examining some of the same issues was reported by Magjuka & Baldwin (1991). Here the focus was on factors that contribute to the successful implementation of team-based employee-involvement programs and the longer-term effective performance of teams in such programs. Through teams employees have voice in organizational affairs, gain access to information and address problems previously reserved for management, and take on new and varied responsibilities. On the basis of results from their national survey, Magjuka & Baldwin identified factors thought to contribute to the effectiveness with which employee involvement teams are designed and implemented. They then obtained additional data and examined relationships between these factors and effectiveness for 72 teams in two manufacturing firms. They found that larger team size, greater within-team heterogeneity (in terms of the kinds of jobs team members held), and greater access to information were positively associated with team effectiveness. The implications of these findings for designing and implementing employee involvement teams are straightforward. Other factors such as hours spent in meetings and members' wages did not relate to effectiveness.

HETEROGENEITY AND PERFORMANCE The extent to which team effectiveness is affected by the heterogeneity among members is a complicated matter. Magjuka & Baldwin (1991) and Campion et al (1993), as noted above, offer seemingly contradictory findings. Jackson et al (1995), in their paper on diversity in organizations, reviewed and summarized empirical evidence from a number of related disciplines about the link between diversity (that is, within-group heterogeneity) and team effectiveness. Their reading of the literature is that heterogeneity is positively related to the creativity and the decision-making effectiveness of teams. Note that heterogeneity is broadly defined here and refers to the mix of personalities, gender, attitudes, and background or experience factors. For example, Bantel & Jackson (1989) found that organizational innovations in the banking industry were positively associated with heterogeneity of functional expertise among members of the top management teams of firms in that industry. Watson et al (1993) reported that, over time (15 weeks), initial performance differences between newly formed culturally homogeneous and

culturally diverse groups disappeared and eventually "crossed-over," such that culturally heterogeneous groups that initially performed poorly relative to homogeneous groups later performed better than homogeneous groups on selected aspects of task performance (namely, generating alternative solutions and applying a range of perspectives in analyzing business cases). Overall, the Campion et al (1993) finding of a nil or negative association between the heterogeneity of group members' backgrounds and team effectiveness appears to be more the exception than the rule (Jackson et al 1991), though evidence supporting the value of member heterogeneity for team performance is clearest in the domains of creative and intellective tasks. The processes (cognitive, social) through which heterogenous group compositions have their effect on team performance are far from fully specified, though Jackson et al (1995) explore possible mediating processes.

Heterogeneity of members also appears to have other, performance-related consequences. Jackson et al (1991) reported that heterogeneity among members of top management teams in bank holding companies was positively related to turnover in those teams. Wiersema & Bird (1993) found similar, if stronger, results in a sample of Japanese firms. Turnover is usually thought of as dysfunctional for team effectiveness, though it is possible that the consequences of losing and replacing members could work to the advantage of teams in some circumstances.

FAMILIARITY AND PERFORMANCE Another aspect of group composition that has recently been studied for its relationship to team performance is that of familiarity among members. Goodman & Leyden (1991) examined, over the course of 15 months, the productivity (in tons per shift) of coal-mining crews who differed in the extent to which members were familiar with each other, their jobs, and their mining environment. Results indicated that lower levels of familiarity were associated with lower levels of productivity. Watson et al (1991) studied groups who spent more than 30 hours in decision-making tasks and found that group decision-making effectiveness (relative to individual decision-making effectiveness) rose over time, a finding they attribute at least in part to the effects of increased familiarity among members. Dubnicki & Limburg (1991) found that older health-care teams tend to be more effective in certain ways, though newer teams express more vitality. Thus, some evidence indicates that teams composed of individuals who are familiar with one another carry out their work with greater effectiveness than teams composed of strangers. However, one should bear in mind that some older evidence indicates that there may be a point, perhaps two or three years after a group is formed, at which group longevity and member familiarity become detriments to group performance (Katz 1982). In the later section on cockpit crews we provide further discussion of team member familiarity.

Leadership and Group Performance

The effects on group performance of leaders' expectations of group performance were studied in a field experiment by Eden (1990a). The purpose of the intervention was to raise, through information provided by an "expert," group leaders' expectations of their group's performance in a training setting. The groups were platoons in the Israeli Defense Forces in training that lasted 11 weeks. Platoons training under leaders who held high expectations performed better on physical and cognitive tests at the end of training than did comparison platoons. This research extends prior work on the effects of expectations on performance (Eden 1990b) and indicates that such expectancy effects occur in the absence of any lowered expectations for comparison groups.

Jacobs & Singell (1993) offer a different perspective on how individual leaders can affect team performance. They examined the effects of managers (after controlling for other variables) on the won-lost record of professional baseball teams over two decades and found it was possible to identify superior managers. Superior managers were effective through at least two possible processes: by exercising excellent tactical skills or by improving the individual performances of team members.

George & Bettenhausen (1990) studied groups of sales associates reporting to a store manager and found that the favorability of leaders' moods was inversely related to employee turnover. Another study in business organizations examined the position-based power dominance of firms' chief executive officers (CEOs) and their top-management team size as predictors of firm performance (Haleblian & Finkelstein 1993). The study found that firms' performance was worse in turbulent environments when the CEO was dominant and better when top-management team size was greater.

Motivation and Group Performance

In recent years motivation in groups has received more theoretical rather than empirical attention. Much of this attention is devoted to understanding motivation at a collective (group, team) level rather than to strictly confining the motivation construct to an individual level of analysis. For example, Shamir (1990) analyzed three different forms of collectivistic work motivation: calculation (rewards or sanctions are anticipated to follow from group performance), identification (one's self-concept is influenced by membership in a group), and internalization (acceptance of group beliefs and norms as a basis for motivated behavior). Each orientation is considered viable in different circumstances. Guzzo et al (1993) introduced the concept of group potency and defined it as the group's collective belief that it can be effective. They differentiated the construct from other related constructs (e.g. collective efficacy) and reviewed evidence that the strength of this motivational belief sig-

nificantly predicted group effectiveness in customer service and other domains. Guzzo et al (1993) maintained an interest in motivation at the group level of analysis, not at the individual level of analysis.

Individual motivation within groups also has received attention, especially as individual motivation is related to group-level factors. Earley (1994) provided empirical evidence on the role of individualism-collectivism (a culture-based individual difference) in shaping the impact of motivational (self-efficacy) training for individuals. Group-focused training was found to have a stronger impact on collectivist individuals, and self-focused training was found to have a greater impact on individualists. For Earley, a central research question was how individual motivation is affected by the match of motivational training to the individual values of trainees. Sheppard (1993) offered an interpretation of individual task-performance motivation in groups that drew heavily on expectancy theory (e.g. Vroom 1964), reinterpreting within the expectancy theory framework evidence on individual motivational deficits in the form of social loafing and free-riding in groups.

Group Goals

Related to issues of group motivation are issues of group goals and goal-setting. Goals for group performance can take many forms: quantity, speed, accuracy, service to others, and so on (see Brawley et al 1992 for an exploration of the types of goals set by sports teams). And the evidence is clear that, compared with the absence of goals (or the presence of ill-defined goals), specific, difficult goals for groups raise group performance on those dimensions reflecting the content of the goal (Weldon & Weingart 1993). That is, goals for quantity tend to raise quantity, goals for speed tend to raise speed, and so on.

There are occasional reports of failures of group goals to induce performance effects (see Fandt et al 1990 for an example). Despite the exceptions, there does appear to be a strong evidentiary basis for the performance effects of goals. In light of this, research has been redirected toward understanding the processes through which goals have their effects. Weingart (1992), for example, examined in a laboratory experiment member effort and planning, two possible mediators of goal effects, and found evidence indicating that member effort mediated the impact of goal difficulty on performance. The quality of the planning process also affected group performance in the expected direction but was not observed to be a result of goal levels. Weldon et al (1991) and Weingart & Weldon (1991) also provide evidence that group goals raise member effort, but only in the former study did that effort translate into increased group performance. Other possible mediators of the effects of group goals include the degree of cooperation and communication they stimulate in groups (Weldon & Weingart 1993; see also Lee 1989, Locke & Latham 1990).

Goals for group performance often coexist with goals for individual performance. When group and individual goals conflict, dysfunctions can result. However, it is not necessarily the case that even when group and individual goals are compatible the presence of both results in levels of performance higher than when either goal type exists alone. Specifically, Mitchell & Silver (1990) found that the presence of both individual and group goals resulted in performance no greater than that attained in the presence of group goals alone. Self-efficacy has also been explored in this context, with Lee (1989) showing that team goal-setting mediated the relationship between team-member self-efficacy and winning percentage among several female field hockey teams.

Other Issues

Other issues of long-standing interest because of their relationship to group performance effectiveness include feedback and communication in groups. For example, in a study of a collegiate volleyball team, de Armas Paredes & Riera-Milian (1987) found won-lost records to be related to the quality of intrateam communication. The performance effects of feedback were investigated in a study of railway work crews by Pearson (1991), who found small but statistically significant increases in productivity over time as a consequence of receiving performance feedback. The effect of task-performance feedback also was investigated by McLeod et al (1992). However, they found no significant change in task performance effectiveness attributable to such goal-referenced feedback. They also investigated the effects of feedback that concerned interpersonal processes in groups and did detect a change in the dominance behavior of individuals attributable to it.

KINDS OF GROUPS

The preceding section reviewed recent research on long-standing issues of relevance to group performance. Issues such as composition, motivation, and leadership are of near-universal importance to groups. They are relevant to many types of teams in many kinds of settings. In this section we consider recent research on particular types of groups.

Many classifications of groups into types have been offered. Hackman's (1990) book, for example, organizes its reports of groups into categories such as service (e.g. delivery) and performing (e.g. symphonic) teams. In this section we, too, specify different kinds of groups on the basis of the work they do. We do not offer the following categories as a typology that we expect to have value outside of the confines of this review. Instead, the categorizations defined below are a matter of convenience for organizing recent research literature.

Flight Crews: Teams in the Cockpit

"The crew concept" in airlines has had many names over the years. The phrase "Cockpit Resource Management" initially took hold. More recently, this focus has come to be known as "Crew Resource Management" (CRM) owing, in part, to the recognition of the importance of including persons not actually in the cockpit (e.g. controllers, flight attendants, etc) as part of the team (Lauber 1993).

CRM has been defined as "using all available resources—information, equipment, and people—to achieve safe and efficient flight operations" (Lauber 1984). The practical importance of such a program is shown in the fact that over 70% of all severe aircraft accidents between 1959 and 1989 were at least partially attributable to flight crew behavior.

In general, CRM training includes "not only optimizing the person-machine interface and the acquisition of timely, appropriate information, but also interpersonal activities including leadership, effective team formation and maintenance, problem solving and decision making, and maintaining situation awareness.…It represents a new focus on crew-level (as opposed to individual-level) aspects of training and operations" (Helmreich & Foushee 1993, p. 4). Helmreich & Wilhelm (1991) noted that CRM training is generally well received by trainees and leads to positive changes in crew members' attitudes about both crew coordination and personal capabilities (or self-efficacy). However, they also acknowledge that in a small percentage of trainees there is a "boomerang effect" in which attitudes become less positive.

Related to CRM training is Line-Oriented Flight Training (LOFT), which is a broad category encompassing flight simulations conducted for several purposes (e.g. to qualify as a pilot, for training). Butler (1993) asserted that LOFT is most important as a training methodology to reinforce CRM concepts and training. This type of LOFT is called CRM LOFT, and it is ongoing, systematic flight simulation of realistic problem situations that require the type of decision-making skills and crew communication that are taught in CRM training. Wiener et al (1993) provide an excellent review of literature on CRM training and LOFT.

CRM AND CREW COMMUNICATION Communication is one of the major areas covered in CRM training (Orlady & Foushee 1987). In the context of CRM training, communication includes such things as "polite assertiveness and participation, active listening, and feedback" (Orlady & Foushee 1987, p. 199). Though effective communication is almost universally recognized as crucial to effective flight crew performance, and CRM training is generally seen as improving communication skills of flight crew members, there is little experimental or quasi-experimental research on the effectiveness of CRM's commu-

nication training for improving outcomes. Instead, the majority of the research examines the effects of CRM training on process variables.

Effective crew coordination is in large part a function of effective crew communication, and so we note research by Stout et al (1994), though not quite a CRM-based study. Their preliminary investigations used a low-fidelity flight simulator, and they examined the interactions among two-person teams of undergraduate volunteers. They found that, when team members must act interdependently to perform effectively, increased levels of such team process and communication behaviors as providing information before it is needed, planning, asking for input, and stepping in to help others were all related to increased effectiveness. Urban et al (1995) had similar results in another non-CRM laboratory study in which they examined the impact of workload and team structure on effectiveness.

CRM AND DECISION MAKING Diehl (1991) suggested that 50% of all accident-related errors are errors of decision. Thus, the question of whether CRM can enhance the quality of decision making in the cockpit is an important one.

Flight crews are in some ways like many other types of groups that make decisions. Power dynamics are present, and traditional group decision-making pitfalls (e.g. groupthink, risky shift) must be avoided. Flight crews are similar to other groups in that they determine what the situation is, assess available options, and choose among them.

In other ways, though, decision making in the cockpit is unlike other group-decision situations. One significant difference is that crew decision making is hierarchically managed decision making: Each member of the crew contributes his or her knowledge and opinions, and the captain is the final decision-maker. Finally, there is a great variety of expertise available in a flight crew, making flight crews perhaps more heterogeneous than many other types of decision-making groups (Orasanu 1993).

CONTEXTUAL VARIABLES There are several contextual variables that play a role in airline crew performance and process. One of the most significant is the limited duration of flight crews' existence as a unit. In the commercial airline industry, a given flight crew will probably only work together for at most four days, and sometimes will be together for only part of one day. Indeed, commercial airline flight crews perhaps most closely resemble project teams or task forces in that they are composed of persons with expertise in a specific area (e.g. navigator, captain) and work together for a limited period of time, after which members are reassigned to other flight crews.

Because of this, CRM training and LOFT are conducted in the context of a team (all of the members of a CRM or LOFT flight crew are trainees). Further, the training is not done with the intention of strengthening *that particular*

team, but rather with the goal of making the individuals more effective in whatever team/flight crew they find themselves.

Crews learn to develop relationships quickly (Bowers et al 1993a, Foushee et al 1986). This process can be facilitated by the standard preflight briefing. In this meeting, the captain lays out his or her expectations for the crew and states the goals of the flight (Ginnett 1993).

Finally, and most significantly, Foushee et al (1986) found that newly formed crews communicate less effectively and are more likely to have accidents than are crews that have been intact for at least a short time. This is the primary reason that Hackman (1993) recommended that the system of scheduling flight crews be modified, though he recognized that there would be strong resistance to this idea by flight crew personnel. Note that this mirrors the studies cited earlier suggesting that teams composed of individuals who are familiar with each other will in general be more effective than teams composed of people who do not know each other at all, as is often the case in newly formed cockpit crews. Indeed, the United States Army embraced this view when they mandated "battle-rostering" of crews (assigning aviation crews who work together for extended periods of time). However, recent research by Leedom & Simon (1995) suggested that battle-rostering for the long-term may lead to overconfidence—and errors—among aviators.

Leedom & Simon (1995) also noted that the underlying purpose of battle-rostering and other tactics to increase team member familiarity is to increase predictability of behavior in the team setting. They explored the effectiveness of standardized behavior-based training to improve team coordination and functioning and found that this approach led to higher levels of performance than did battle-rostering and that it did so without the potential overconfidence effects found with battle-rostering. Thus, the issue of crew structure and familiarity remains open.

A second contextual issue is the increasing level of automation in the cockpit. With new aircraft designs and the emergence of the "glass cockpit," crews face new issues of communication, interaction, and decision making. One reason for the emergence of new automation is the attempt by aircraft manufacturers to reduce human decision making as much as possible—because people too often make bad decisions (Billings 1991). Bowers et al (1993b) found in a simulator test that the addition of automation decreased the perceived workload, but this decrease in workload did not necessarily result in increased performance. In fact, in difficult situations the nonautomated crews made better decisions than the automated crews. Further, Costley et al (1989) found that there were lower communication rates in more automated aircraft, though there was no decrease in operational actions.

MILITARY FLIGHT CREWS Although there are of course many similarities between military flight crews and commercial flight crews, there are also some significant differences between the two. Military flight crews may be significantly larger, for example, and they are likely to remain together as a unit for much longer periods of time than are commercial flight crews, owing to battle-rostering (described in the preceding section). Further, issues of rank of personnel may play a greater role in the military flight crews, and this may be at odds with the assertiveness taught in most CRM-type training. Finally, military flights in peacetime are almost always training flights of some kind, whereas commercial flights are for the purpose of transportation of cargo and passengers rather than for training (Prince & Salas 1993).

Despite those differences, CRM and LOFT-type training programs have been developed by several branches of the military (often called Air Crew Training, or ACT) (Prince & Salas 1993). These ACT programs have generally similar results to CRM training and LOFT, and the research findings from one area generally mirror those of the other. For example, the finding that there is a high correlation between CRM-type behaviors and objective and subjective measures of the effectiveness of aircrews (Povenmire et al 1989) could easily have come from either the commercial or the military air crew research programs.

Further, Prince & Salas (1993) note several similarities between military and commercial research into the origins of flight difficulties. These included problems with the exchange of information in the cockpit, the distribution and level of priority of tasks, and relationships within the crew.

It is important to note that CRM- and LOFT-type training has not yet fully taken root in the military's flying culture, and that the programs that have been developed vary from one service branch to another and from one command to another. This lack of consistency across commands and services may make full-scale adoption and acceptance of such programs more difficult to achieve in the military than in the commercial airlines.

OVERALL EFFECTIVENESS OF CRM TRAINING AND LOFT As noted above, there is a great deal of research on the effectiveness of CRM training and LOFT, and this body of work is explored in much greater detail in Wiener et al (1993) than can be covered here.

In summary, however, compared with no training of crews in CRM, training in CRM results in more crews being rated by crew evaluators as above average and fewer being rated as below average (Helmreich et al 1990). Further, skills learned in CRM training and LOFT are often cited by pilots as playing a key role in their handling of crisis situations (e.g. National Transportation Safety Board 1990a,b).

Computer-Assisted Groups

The continuing spread of computerization has been accompanied by an expansion of research on groups that use computers in their work. This research has in large part focused on comparing computer-mediated group meetings with non-computer-mediated meetings and, where work is done by groups, on idea generation and choice making.

An interpretation and annotated bibliography of studies, especially experiments, on computer-assisted groups, is provided by Hollingshead & McGrath (1995). They identified fifty research reports over two decades yielding about 150 findings relevant to task performance in computer-mediated groups. Almost all studies were done in laboratories with ad hoc groups. Overall, Hollingshead & McGrath found that computer-mediated groups tended to be characterized by less interaction and exchange than face-to-face groups and tend to take longer in their work. Whether computer-mediated or face-to-face groups are superior in task performance (on dimensions other than speed) appears to depend on the task. Specifically, computer-mediated groups appear superior at generating ideas but face-to-face groups appear superior on problem-solving tasks and tasks requiring the resolution of conflicts (of preferences, for example). They also suggest that a large part of the effect of computer technology in groups may be due to structuring of the task imposed by the use of computer technology rather than other aspects of the electronic medium.

It is interesting to note that increased structuring of the task—whether by computers or by nontechnological means—seems to enhance group processes. Consider, for example, the "stepladder technique," in which a core group of perhaps two members make a tentative decision, and with each successive "step" a new member is added and a presentation is made of the group's current ideas, followed by a renewed discussion of the possibilities. Rogelberg et al (1992) found that groups using this highly structured process produced higher quality solutions (to a survival problem) than did groups using conventional discussion methods. Further, Hartell (1991) demonstrated that teams of undergraduates trained in and utilizing a system of Problem Identification/Verification dealt with trouble-shooting tasks more effectively than teams who were not trained.

CREATIVITY AND BRAINSTORMING Examples of research on brainstorming can be found in the work of Gallupe, Valacich, and colleagues. Dennis & Valacich (1993) reported that electronically interacting groups (i.e. communicating via computers) produced more ideas during a brainstorming task than did nominal groups (i.e. those whose members did not interact). Gallupe et al (1991, 1992, 1994) compared face-to-face brainstorming with electronic brainstorming groups and found the latter to be superior or the equal of interacting groups.

These studies suggest that the electronic brainstorming medium reduces the extent to which the production of new ideas is blocked by such things as listening to others or waiting for a turn to speak.

Sainfort et al (1990) compared experimental groups using a computer-aided decision system, a videotape training system in conflict resolution, or no support system. They found that the computer-aided groups generated more potential solutions to the problem and perceived themselves as making greater progress than either of the other groups. Also, both technology groups (computer and videotape) were significantly more effective in solving the problem than the control group. All of this research corresponds to the conclusions of Hollingshead & McGrath (1995).

DECISION MAKING McLeod's (1992) meta-analysis of 13 studies examined the relationship between various electronic group decision support systems and group process outcomes. It was shown that the use of electronic group support systems in group decision making leads to increases in decision quality, level of focus on task, equality of participation, and the length of time required to reach a decision. However, use of a group decision support system led to decreases in overall consensus and in satisfaction with the process and the decision.

George et al (1992) examined whether the inclusion of a facilitator among groups making decisions using an electronic meeting system would have an effect on the group process or quality of decisions made. They found that there were no differences in either group process or outcomes (i.e. decision quality) between groups that determined their own group process and those for whom the group process was determined by a facilitator. Similarly, Archer (1990) found that if the phases of a decision process in a complex business situation were organized and rational, there was no difference in decision quality between computer-mediated and face-to-face decision making.

CONTEXTUAL ISSUES Contextual factors other than the computer programs themselves also play a role in computer-assisted groups. Valacich et al (1994) found significantly different results between groups using the same computer-mediated communication system when all members of the group were in one room as opposed to when the members were dispersed. In this case, the dispersed group generated more unique solutions and solutions of higher quality than did the proximate group.

COMMUNICATION PATTERNS Several authors have reached similar conclusions about communication patterns in groups who communicate solely or primarily by computer. For example, Kiesler & Sproul (1992) found that communication in such groups is characterized by greater direct advocacy, greater equality of participation (even when members are of different status

levels), more extreme or risky decisions, and more hostile or extreme communications (e.g. "flaming") than in face-to-face groups. Dubrovsky et al (1991) also found that social-status inequalities were less salient in groups who communicated and made decisions by electronic mail than in face-to-face groups. However, they also found that differences in influence based on differences in expertise were less pronounced in e-mail groups. They refer to these phenomena as "the equalization effect."

In some computer-mediated decision systems, communication among members is anonymous. Jessup et al (1990) reported three experiments in which they showed that when there was anonymity in the group decision-making process, members were more critical of ideas proposed, more probing in their questioning, and more likely to generate questions and ideas.

GROUP PROCESSES Sambamurthy et al (1993) found that experimental groups using a computerized group decision support system to make budget allocation decisions had better organized decision processes than did groups using a paper-and-pencil version of the decision support system and than a control group to which no decision support system was provided. However, the computerized system also appeared to reduce the thoroughness of the discussion and led to a less intensely critical decision process. Likewise, Poole et al (1993) found that use of a group-decision support system improved the organization of subjects' decision-making process but may have led to less thorough and critical discussion. Keys et al (1988) used undergraduates in a study of the effects of use of a decision-support system in a business strategy game, and found that students in the computer condition did more and better planning than those in a control condition. Aiken & Riggs (1993) examined the applicability of a group decision-support system, in which communication among group members was almost entirely electronic, to the question of group creativity. They found that groups using the group decision-support system were more productive and more satisfied with the process because of such things as increased participation, synergy, and enhanced structure.

SHORTFALLS OF COMPUTER-MEDIATED GROUP WORK Computer-mediated group work is not always superior to face-to-face interaction, however. Straus & McGrath (1994) found that the productivity (in terms of quantity but not quality) of face-to-face groups on discussion tasks exceeded that of electronically mediated groups and that this productivity difference was greatest on those tasks requiring higher levels of coordination among group members. Lea & Spears (1991) confirmed previous research that groups communicating by way of computers produce more polarized decisions than do face-to-face groups. Adrianson & Hjelmquist (1991) found less conformity and opinion change in groups using computer-mediated communication than in those using face-to-

face communication and found that personality characteristics of group members were only weakly related to these communication patterns.

OTHER TECHNOLOGIES Computers are, of course, not the only technological innovation used for group communication and decision making. More simplistic technology such as teleconferencing has also been introduced. Interestingly, the negative interpersonal interactions found in computer-based communications (e.g. "flaming," increased time to decision) appear to be absent in teleconferencing, which is much more similar to face-to-face communications. Groups making decisions via teleconferencing tend to take less time than do face-to-face groups, and members tend to perceive the leader as taking on fewer leadership roles (Rawlins 1989).

SUMMARY Technological systems that more closely mimic face-to-face interaction (e.g. videophones and videoconferencing) are becoming more widely available, and these advances will spur new research into their use as group decision-making tools. Simultaneously, use of systems in which there is no real-time communication is also becoming more and more common (e.g. groupware, list-servers). These communication systems provide ample opportunities for research. We believe that technology-based group communication and decision-making systems will continue to thrive and that researchers will have to struggle to keep up with the pace of programmer advances and practitioner usage.

Defined Problem-Solving Groups

Some groups are created for the specific purpose of generating solutions to problems. Quality circles and task forces are two such kinds of groups.

QUALITY CIRCLES Quality circles were developed as a means to generate ideas that, if implemented, would raise the product quality by reducing defects, error rates, and so on. Quality circles were a precursor in the United States to the more recent "total quality movement" in which many mechanisms of quality (and, more generally, productivity) improvement are implemented to foster continuous improvements in the quality of products and of services. Quality circles typically are 6–12 employees who perform related jobs and who meet to discuss problems—and opportunities—to raise the quality or productivity of their part of an organization. They generate solutions that may or may not be implemented by the organization. The introduction of quality circles usually is accompanied by training in group process (e.g. in structured techniques for diagnosing problems and brainstorming) as well as training in aspects of quality management, such as in working with statistical indicators of quality.

Although quality circles have been a popular form of groups in organizations, evidence suggests that quality circles have relatively little enduring impact on organizational effectiveness (Lawler et al 1992) and research on them has diminished. Steel et al (1990) studied quality circles over a 14-month period in a United States federal mint and found no evidence that they affected important organizational outcomes. Quality circles may sometimes be successful at generating so-called big hits early on (i.e. quality improvements that have substantial economic value to a firm) but the evidence does not indicate that quality circles can maintain such contributions over time.

TASK FORCES Task forces are another kind of group created to solve problems. They are temporary, created with a relatively well-bounded mandate to be fulfilled. Task forces have a more limited time horizon than do quality circles; once the task is accomplished, the task force can disband. May & Schwoerer (1994) reported on the creation of task forces to develop and implement ways of reducing the incidence of cumulative trauma disorders (or CTDs) that result from repetitious, forceful movements in a meat-packing plant. (Carpal tunnel syndrome is one such disorder.) Teams were made up of 7–9 volunteers representing several functions (e.g. medical, management) and were trained in substantive issues related to CTDs. The teams appeared successful in decreasing the incidence and severity of CTDs, though the number of production days lost to injuries was unaffected. The authors of the report also presented their views on the appropriate structure, training, and support of task forces similar to those studied.

AUTONOMOUS WORK GROUPS We use the label "autonomous work groups" as a synonym for "self-managing teams" and for "empowered teams." These are teams of employees who typically perform highly related or interdependent jobs, who are identified and identifiable as a social unit in an organization, and who are given significant authority and responsibility for many aspects of their work, such as planning, scheduling, assigning tasks to members, and making decisions with economic consequences (usually up to a specific limited value) (e.g. see Dobbelaere & Goeppinger 1993).

The concept of autonomous work groups has been in the literature for half a century. However, there was little momentum for their adoption in US workplaces until the past decade or so as firms reduced levels of management, thus giving over to lower-level employees responsibilities in the past held by management, and as firms sought new ways of increasing employee involvement and productivity. Autonomous work groups are inherent in many recent attempts to radically transform organizational work systems, a topic discussed in the next section on teams and organizational change. This section deals with research specifically targeted at autonomous work groups.

Cohen & Ledford (1994) studied a large sample of self-managing teams at different levels and in varying functions in a service organization. These self-managing teams had been in existence for two years on average. They were systematically matched against comparable traditionally managed teams. Further, teams were screened from the sample when they did not unambiguously fulfill the definition of self-management. Criteria of team effectiveness included ratings on different dimensions of performance (e.g. quality, productivity, safety) obtained from different sources (team members and higher levels of management) as well as indicators of effectiveness from company records, such as customer complaints and monetary losses due to absenteeism. Ratings indicated that self-managing teams were more effective than their comparison groups. However, no significant differences were observed on measures of effectiveness based on company records. Work-related attitudes (e.g. satisfaction) were more favorable among members of self-managing teams.

Cordery et al (1991) reported a study of autonomous work groups at a greenfield site. A greenfield site is a new physical location of work. In this study of mineral processing plants in Australia, work groups at the new plant site were compared with groups in existing sites. An important differentiating feature of the new site was that an organizational structure unlike those at any existing sites was implemented. That organizational structure "centered on the operation of autonomous work groups in the processing area" (Cordery et al 1991, p. 465). Greenfield teams in this site had decision-making responsibility for such things as allocating work, attending to administrative matters, and setting priorities, as well as having influence on hiring decisions. Their members also acquired multiple skills and worked under a pay-for-skills reward system. Traditional (nonautonomous) groups, against which autonomous work groups were compared, also existed in parts of the new plant and in the established site. The primary intervention was thus a change in the nature of group work, in the competencies of members (through multiskilling), and in groups' supporting organizational context (reward system, authority system, information availability). This intervention secondarily influenced individual inputs through its creation of multiskilled group members.

The Cordery et al (1991) data indicated that autonomous work groups were associated with more favorable employee attitudes than were traditional work groups, though this difference abated over time (measurements were made at 8 and 20 months after the greenfield start-up). However, both turnover and absenteeism were higher among members of autonomous work groups in comparison with traditional groups.

The Cordery et al (1991) study was much like an earlier study by Wall et al (1986) that contrasted autonomous work groups in greenfield and established sites engaged in food production. The earlier study also found higher turnover

among employees in the greenfield site. However, the findings of these two studies contradict the report by Weisman et al (1993), who found that higher retention (i.e. lower turnover) among nurses was associated with self-management practices. A previous review of research by Beekun (1989) concluded that the use of autonomous work teams is associated with decreases in absenteeism and turnover. Other results that differed from Cordery et al (1991) were reported by Wall et al (1986), who found less evidence of positive attitudinal consequences of autonomous work groups than did the latter study. Barker's (1993) case study report noted that members of self-managing teams had lower levels of absenteeism and tardiness because the members of the teams enforced attendance and on-time norms much more strictly than managers had enforced those policies prior to the implementation of teams.

Overall there is substantial variance in research findings regarding the consequences of autonomous work groups on such measures as productivity, turnover, and attitudes. This variance may indicate that the effects of autonomous work groups are highly situationally dependent. That is, the effects of autonomous work-group practices may depend on factors such as the nature of the work force (e.g. its dominant values) and the nature of the organization (e.g. information and reward systems). Smith & Comer (1994) did address the proposition that the success enjoyed by self-organizing teams (self-organizing teams are similar to autonomous work groups) may depend on the situation. Through a laboratory experiment, Smith & Comer demonstrated that self-managing groups can be expected to be more successful in turbulent environments. This study is unique in its attempt to provide direct answers to complex questions about the "fit" of autonomous (and related forms of) work groups. Considerably more research will be required, given the number of possible factors that could moderate the impact of autonomous work groups in organizations.

TEAMS AND CHANGE IN ORGANIZATIONAL SYSTEMS

Groups are almost always embedded in larger social systems (e.g. communities, schools, business organizations). These social systems that surround teams define a major part of the context in which team performance occurs. As Levine & Moreland (1990) have pointed out, too much past research on group performance effectiveness has been devoid of attention to the linkages between group performance and aspects of the social systems in which groups are located. For theorists such as McGrath (1991), a fundamental assumption about the nature of groups is that they are partially nested within, and loosely coupled to, a surrounding social system. "Partially nested" refers to the fact that individuals often are members of more than one group and that groups may be parts of more than one social system. "Loosely coupled" refers to the

fact that there are few clear, mechanistic-like connections either between groups and surrounding systems or within groups, a point similar to Guzzo & Shea's (1992) metaphor of groups being systems more like clouds than clocks. Another of McGrath's (1991) fundamental assertions about the nature of groups is that in such systems they perform multiple tasks concurrently.

There are several consequences of taking seriously the concept of the embeddedness of teams in organizations. One is that team performance effectiveness and the factors that bring it about are tied to the nature and effectiveness of the entire organization. Changes in team effectiveness can thus have consequences for change in the larger system, such as when improved performance by a team or set of teams is thought to yield greater profits for a business. Perhaps we usually think of team-organization linkages in just this way: that team performance contributes to organizational performance.

The regularity and strength of such linkages between the performance of components (individuals, teams, departments) and overall organizational effectiveness is explored in Harris (1994). That work mostly addresses the apparent paradox that investments in computer technology may bring about improvements in performance at the component level but do not necessarily translate into larger system improvements. It also raises widely applicable issues about measurement, the nature of social systems, and cross-level influences. In light of these considerations, it could be quite wrong to make the easy assumption that improvements in team performance yield gains for the whole organization.

Team-organization linkages also imply that changes in the larger social system can bring about changes in the teams situated in it. That is, one need not directly intervene into teams to change their performance: Interventions into the surrounding organizational system may bring about improved (or, if the intervention is a poor one, reduced) team performance.

The teams-in-organizational-context perspective is complex. It obscures cause-and-effect relations so perceptible from experimental studies of groups stripped of context. It implies that the effects of interventions made at one level (individual, group, organization) may reside at another level. And it implies that multiple simultaneous influences on and of teams may be taking place in these social systems. Complicated though it is, it is imperative to examine research evidence on teams and change in organizational systems.

Research evidence on teams and organizational change tends to be of a unique character. Understandably there are fewer controlled, experiment-like methods and far more case studies and surveys. This is an embodiment of a classical trade-off of rigor for relevance in research. However, there are by now quite large numbers of less-rigorous but highly relevant research reports.

It is likely that weaknesses of research design in some are at least partly compensated by strengths in the research designs of other reports.

An indication of just how many such reports exist is given by Macy & Izumi (1993). They presented the results of a meta-analysis of 131 field studies (yielding 506 effect-size estimates) of organizational change that appeared over a 30-year period. Interestingly, they encountered 1800 studies, only 131 of which provided sufficient quantitative data for their meta-analysis. (Of these 131 studies, 88.5% were published in refereed journals.) We focus first on their findings with regard to broad organizational change and then address those findings most specific to teams in organizations.

In regard to overall organizational change, Macy & Izumi (1993) found that indicators of financial performance show the greatest improvements when multiple changes are simultaneously made in aspects of organizational structure, human resource management practices, and technology. Macy & Izumi report a +0.37 correlation between the number of changes made ("action levers" in their terminology) and indicators of financial performance. Other criteria of change (e.g. employee attitudes) showed no such relationship. But of the many action levers that can be pulled in large-scale organizational change efforts, which specific ones have the greatest impact?

With effect-size measures of financial performance as dependent variables, the action levers with the greatest impact included the creation of autonomous work groups and team development interventions. Group-oriented interventions also showed evidence of improving behavioral measures of performance such as turnover and absenteeism. Other interventions showing appreciable relationships to financial indicators of organizational performance included job redesign, increased employee involvement, changes (mostly flattening) of organizational hierarchies, and changes in workflow. (Macy & Izumi 1993 suggest viewing these findings with caution owing to the sometimes small number of cases on which they are based.) Employee attitudes showed little systematic improvement with these interventions.

In summary, according to Macy & Izumi (1993): Multifaceted, system-wide organizational interventions show the most reliable positive impact on organizational effectiveness, team-oriented interventions are one of a few subsets of interventions that have the most notable effects, and team-oriented interventions affect both financial and behavioral measures of performance.

A nonquantitative, comprehensive review of research evidence on teams, organizational systems, and effectiveness was provided by Applebaum & Batt (1994). Applebaum & Blatt described alternative organizational systems in which teams are of greater or lesser significance as well as attempts to transform organizations to more team-based social systems. Historically, according to these authors, teams are significant elements in Swedish sociotechnical and Japanese lean-production models of work organization. In contrast, teams

have not been emphasized in German or traditional American human resource models of organization.

With existing models of work organization such as these as a backdrop, Applebaum & Blatt (1994) examined experiments in workplace innovation in American organizations. Applebaum & Blatt draw on two lines of evidence about the use of innovative work practices and their impact. One line of evidence consists of 12 large surveys reported between 1982 and 1993. The other consists of 185 case studies.

With regard to teams, Applebaum & Blatt (1994) related that in recent years many US organizations have been experimenting with team-based work arrangements. More specifically, it was estimated in 1990 that 47% of large US companies made use of self-directed, autonomous work teams and that there was a strong growth trend in the use of such teams from 1987 to 1990 (Lawler et al 1992). Quality circles were the most frequently implemented type of team, estimated to be present in 66% of the largest companies in the United States (Lawler et al 1992). Another estimate of the popularity of teams in organizations was provided by Gordon (1992). Gordon reported that 80% of organizations with 100 or more employees used teams in some way and that 50% of employees in these organizations are members of at least one team at work.

There are, however, many variations in team-based organizational practices. In some organizations the introduction or renewed emphasis on teams represents only a small marginal change to standard operating procedures while in others the adoption of teams is a part of a large-scale attempt at radical organizational transformation. Further, in some but not all organizations the implementation of team-based work arrangements may be accompanied by changes in hiring, compensation, decision making, technology, and other processes. As Applebaum & Blatt (1994) aptly noted, in practice "teams" is one of several "commonly abused terms" (p. 72). Given this variation, the path to unambiguous conclusions about the connections between teams and organizational effectiveness is often quite hard to find. The following conclusions are offered cognizant of the caveats and qualifications required by the state of the research evidence.

Applebaum & Blatt (1994), largely on the basis of their review of case studies, concluded that there is clear evidence that team-based work arrangements bring about improved organizational performance, especially in measures of efficiency (e.g. reduced cycle times in production) and quality (e.g. fewer defects in products). Some research reports run counter to this conclusion (e.g. Robertson et al 1992). However, Applebaum & Blatt's (1994) conclusions are supported by the work of Levine & D'Andrea Tyson (1990), who examined the effects of employee participation on productivity. Levine & D'Andrea Tyson identified three forms of participation: consultative, repre-

sentative, and substantive, the latter form constituting the greatest degree of participation. Consultative participation, for example, may come through the creation of quality circles, representative participation through labor-management committees, and substantive participation through autonomous work groups. Cotton (1993) also largely concurred, identifying autonomous work groups and self-determining teams as structures that provide far more participation than quality circles or various forms of representative participation. Levine & D'Andrea Tyson (1990) reviewed empirical evidence from diverse sources (e.g. organizational psychology, economics, industrial relations) and concluded that "participation *usually* leads to small, short-run improvements in performance and *sometimes* leads to significant, long-lasting improvements in performance" (p. 203, emphasis in original) and that "there is usually a positive, often small effect of participation on productivity, sometimes a zero or statistically insignificant effect, and almost never a negative effect" (pp. 203–4). Substantive participation, according to Levine & D'Andrea Tyson, is the form most likely to result in significant, long-lasting increases in productivity, and work teams are the primary means by which substantive participation is attained. Cotton (1993), too, found self-directed work teams to be "an effective way to improve employee productivity and attitudes" (p. 199) and found little evidence that consultative or representative participation has the same consequences.

A national survey of 727 US work establishments conducted in 1991 also is a source of evidence on the impact of team-based organizational arrangements (see Spaeth & O'Rourke 1994 for a description of the survey procedures). An establishment is a location of employment. Small business enterprises are more likely to have a single establishment whereas large enterprises have many. The relationship between performance and the team-based work practices was analyzed by Kalleberg & Moody (1994). They found that organizations adopting sets of practices that included teams as an important element of organization design tended to excel on several performance dimensions (e.g. employee relations, product quality) though not on the dimension of customer service. Note that in this survey performance was assessed by ratings (rather than, say, by measures of output) made by an establishment's representative, the same representative who provided other information about their establishment. Thus, in this survey, the potential exists that some part of the observed relationships are attributable to a response-response bias.

In summary, ample evidence indicates that team-based forms of organizing often bring about higher levels of organizational effectiveness in comparison with traditional, bureaucratic forms. This evidence, however, is confounded because more than one change (e.g. more than just the creation of teams) typically is implemented in studies of organizational change, and measures of effectiveness reflect more than just those contributions uniquely attributable to

teams. The question "What makes teams effective?" is directly addressed by research on group composition, leadership, goal setting, and the like. In contrast, researchers on teams and organizational change ask "To what extent do teams as elements in larger social systems contribute to system effectiveness?" For many group researchers and theorists this is a rather nontraditional question. And it is a vexing question for all, although there is consistent, and sometimes quite powerful evidence that teams contribute to organizational effectiveness.

DISCUSSION

This review has sampled a wide-ranging collection of research studies on team effectiveness, focusing on work teams in organizational systems. Studies emphasized in the review are those centrally concerned with some aspect of effectiveness as a dependent variable and with changes and interventions made to influence the effectiveness with which teams perform. Rather than restating the findings in summary form, this final section considers selected issues raised by the research review. We first highlight three open issues (out of many) in team effectiveness research. Then, newer waves in team research are identified and briefly considered, including those most directly related to issues discussed in this review. Finally, we discuss "points of leverage" for intervening to affect team performance. Thoughts on future research and theorizing are offered throughout.

Open Questions

What is diversity? How does it affect team performance? These two open questions about team composition and effectiveness provide fertile soil for further research and theorizing.

DIVERSITY Diversity refers to dissimilarity among members in terms of gender, ethnicity, race, personality, culture, and functional experience, among other things. There is evidence that team effectiveness is well-served by diverse members when teams perform cognitive, creativity-demanding tasks. This is not to say that diverse membership might not pay off in enhanced effectiveness in other task domains; rather, too little is now known to draw firm conclusions. Also, it is not known whether all forms of diversity contribute in similar portions or in similar ways to team performance on intellective tasks. In fact, there is a real need to develop theory and data on the ways in which dissimilarity among members contributes to task performance. Just as research on goal and team performance has begun to emphasize the mediating processes connecting goals and team effectiveness, research on diversity in teams should increasingly emphasize the processes that mediate its effects.

FAMILIARITY When does familiarity help and hurt team effectiveness? Research on familiarity among coal-mining crews, cockpit crews, and other work groups shows a benefit to familiarity. That is, the greater the familiarity among members of a group, the greater their performance. However, other research indicates that too-familiar cockpit crews may, in fact, be more inclined to make errors. Perhaps the value of familiarity is time-dependent. That is, high familiarity among members (or high interpositional knowledge, as discussed by Cannon-Bowers et al 1995) may have the greatest utility early in a team's existence, perhaps by fostering the rapid appearance of coordination and integration of team members' efforts. High familiarity may have value at other times, too, such as in times of stress or high demand. However, familiarity may eventually become a liability as the lack of membership change (and thus the lack of any unfamiliar members being introduced into a team) contributes to stultification and entropy in teams. The venerable work by Katz (1982) suggested that communication within and between teams declines as teams age, thus communication may be an important mediator of the effects of familiarity.

TEAM BOUNDARIES Where are team boundaries? The boundaries of teams are imaginary lines of demarcation separating member from outsider. Boundaries are essential to the definition of teams (Sundstrom et al 1990) and to the psychology of being a member of the in-group vs the out-group. In many instances team boundaries are reinforced by such things as uniforms and the use of space or turf. However, the boundaries of teams may at other times be quite difficult to discern. "Virtual teams"—teams whose members are connected through a network of computers—are examples of teams whose boundaries of inclusion and exclusion may be quite difficult to establish, especially if individuals may selectively join an electronic conversation for some but not all of the team's existence. But problems of establishing team boundaries are not limited to electronic groups. Vandermark (1991) and Lichtenberg et al (1990) suggested that there are benefits to including as team members persons who might traditionally have been considered on the periphery. Vandermark (1991) raised the issue with regard to the inclusion of cabin crews in the cockpit resource management training of flight crews; Lichtenberg et al (1990) raised the issue with regard to psychiatric aides and their role in teams of health-care professionals. Further, viewing teams as entities embedded in larger systems populated by individuals who are members of more than one team also can complicate the identification of team boundaries. We believe that future research is needed to clarify issues of inclusion and exclusion by virtue of team boundaries (for further discussion, see Guzzo 1996), how boundaries relate to effectiveness, and how the nature of boundaries might shape the effects of interventions intended to raise team performance.

New Waves, New Directions

We briefly consider three areas of research in which there have been recent surges of interest: electronically mediated teams, interventions for enhancing team effectiveness, and teams in the context of social systems.

ELECTRONICALLY MEDIATED TEAMS Although the first studies of electronically mediated teams were done nearly two decades ago, the pace of research on such teams has accelerated in recent years. No doubt this is attributable to many factors, not the least of which is the decreasing expense of the technology needed for such research. And new technologies (e.g. videoconferencing, communication, and support software for groups) continually create opportunities to conduct new research. There is no doubt that electronically mediated teams will become an increasingly common feature of the organizational landscape. We therefore suggest that research on electronically mediated groups break free from the tradition of comparing those groups to face-to-face groups. Instead, future research should accept such groups on their own terms. It should focus instead on contrasting technologies and on team effectiveness under different ways of utilizing available technologies. From a practical point of view we need more research on how to maximize team effectiveness with new technologies. From a theoretical point of view we need better insights and explanations of the drivers of the dynamics of team performance and effectiveness under such technologies.

INTERVENTIONS New ways of intervening to improve team effectiveness are in the works. Many of these are tied to a foundation of research on teamwork and effectiveness in military teams. Salas et al (1995) pointed out that, although there have been few direct tests of team-training interventions in recent research on military teams, knowledge has progressed to a point where such training interventions are now possible, grounded in workable conceptualizations of competencies and task requirements in teams. New ways of intervening are also on the horizon due to new methodologies of team research and new theoretical models of team performance (e.g. see Guzzo & Salas 1995).

TEAMS IN CONTEXT A third notable area of expanding research interest is teams in context. The oft-cited recognition that, historically, the bulk of psychological research has examined teams in the absence of consideration of their contexts is giving way to more frequent studies of teams in naturalistic settings, such as organizations. We expect this shift to be accompanied by new theoretical emphases and insights, especially as they relate to the influence of aspects of the teams' environments. In organizations, such environmental factors could include intraorganizational factors such as reward practices and information systems, as well as extraorganizational factors such as the customer demands and business environments.

Points of Leverage

Three primary points of leverage exist for intervening to enhance team effectiveness. One is the design of the group. Design includes such things as specification of membership, of member roles and methods of their coordination, and of goals. Several studies we have reviewed concern design as a point of leverage for raising team effectiveness. Diversity of membership and size of group, for example, have been found to be related to team effectiveness, although the relationships are not completely consistent across all studies or all group tasks. The effect of goals on group performance has been more uniformly found to be positive, although even here we found one study that was an exception to the pattern of evidence. What we are calling "design" is very much like what traditional models of group performance refer to as "inputs" in the input-process-output description of group performance.

The "process" element in the traditional input-process-output model includes both social processes in groups (e.g. cohesiveness) and task processes (e.g. rules of task performance). Group process is thus a second leverage point at which interventions can be made to improve team effectiveness. Some evidence in the literature reviewed found, for example, that group cohesiveness can contribute to performance, and other studies found that structured task processes—such as the stepladder technique for group problem solving—can contribute positively to performance.

The traditional input-process-output model would be too confining if its interpretation were restricted to the idea that inputs (i.e. member characteristics, goals) fully determine group process. Inputs influence group process but may not strongly constrain it. One factor that can strongly constrain group process is the technology with which a group works, such as computers. Our review of computer-assisted groups indeed shows their process to be different (e.g. more equal but less overall member participation) from non-computer-assisted groups and that these differences may or may not result in enhanced effectiveness, depending on factors such as the task.

A third point of leverage for enhancing team effectiveness is the context. That is, team performance can be raised by changing the conditions in which teams perform. Several lines of evidence we have reviewed point to the power of the context as a driver of team effectiveness. Organizational leaders, for example, are a part of the context in which work groups perform, and leaders have been shown to influence team effectiveness. Cockpit resource management and its variations appear to have positive effects on flight crews because such interventions change the organizational context (values, culture) in which crews are formed and carry out their work. Further, large-scale organizational change efforts that change the social system of which teams are a part have been shown to enhance effectiveness. The point of leverage with the most consis-

tent research support for affecting team performance is the context. In fact, it is probably most justifiable to conclude that the greatest changes in team effectiveness are most likely to be realized when changes in teams' organizational context are supported by the appropriate team design and process.

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