

1993

Improving Team Performance By Identifying and Targeting Back-Up Behaviors: A Training Strategy

Rosalynn M. Peron
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Improving Team Performance
by Identifying and Targeting Back-up Behaviors:
A Training Strategy

by
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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

INDUSTRIAL/ORGANIZATIONAL PSYCHOLOGY

OLD DOMINION UNIVERSITY

1993

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ABSTRACT

IMPROVING TEAM PERFORMANCE BY IDENTIFYING AND TARGETING BACK-UP BEHAVIORS: A TRAINING STRATEGY

Rosalynn M. Peron
Old Dominion University, 1993
Director: Dr. Albert S. Glickman

The purpose of this research was to determine if training workshops of short duration (one-to-three hours) could contribute to enhanced teamwork and hence improved team performance for teams at the primary level (first production level) of a natural gas service and installation organization.

The teamwork characteristic of back-up behaviors (i.e., actions to help other team members that require adaption or anticipation and improve team performance by contributing to successful task completion) was the focus of workshop activities. Other strategies were employed to enhance the process such as team-building, goal setting and feedback. Feedback consisted of posting back-up behavior scores (i.e., proportion of "occurred" to "could-have-occurred") and sharing that information with individual team members.

Three teams were subjected to each of four experimental conditions: 1) TBP: three-hour team-building workshop, goal setting for attainment of back-up behaviors and posting; 2) TB: three-hour team-building workshop and goal setting for attainment of back-up behaviors; 3) P: one-hour discussion of back-up behaviors and posting; and 4) C: control participants.

Dependent variables included team member responses to the Teamwork Checklist (Varney, 1989, which addressed teamwork characteristics of leadership, process, interpersonal relationships, and task), supervisor responses to the Performance Indicator (Varney, 1990, which measured team performance and quality), and observations of the occurrence of back-up behaviors on the job.

Results indicate that short duration workshops which focus on back-up behaviors and utilize either goal setting or feedback promote acquisition of targeted behaviors as well as improve team performance even though there is a lack of improvement in other teamwork characteristics. Although not predicted, the one-hour workshop which focused on back-up behaviors and utilized the posting strategy yielded the most marked improvement in overall team performance.

Practical implications are that team performance can be enhanced by identifying and targeting back-up behaviors in short duration activities but follow-up team-building may be required to enhance other teamwork elements. Data from this research were contributed to a national multi-site research endeavor on teamwork characteristics and a training protocol was suggested for use in similar organizations.

DEDICATION

This document is dedicated to family:

To Dr. Louis C. Peron, D.D.S, M.S., my best friend and husband for the past 25 years. Thank you for believing in me always, for your emotional and financial support, and for teaching me how to study!

To Brad Peron and Kim Peron, who have grown from crayons to cars during this process. Thank you for your emotional support and for giving up all those home-made cookies.

To my mother, Rose Ella Smith, who taught me to read and how to start and finish a project on my own.

And lastly, to the memory of my father, Lewis Alton Smith (11-12-13 to 11-6-93), who gave me my "taste" for the business world.

I could not have achieved this accomplishment without the love of you all and I am forever in your debt.

ACKNOWLEDGEMENTS

It is with great pleasure and relief that I can take this opportunity to acknowledge the support and guidance that I have received from my dissertation committee, colleagues, friends and research participants.

First, I would like to thank my chair, Dr. Albert S. Glickman (the "guru"), whose patience and attention to detail are limitless. Your advise, support and guidance throughout the whole course of study have been well appreciated. Thanks especially for encouraging me to share insights with the Anti-submarine Warfare training instructors that ultimately led to this research.

I owe a debt of gratitude to Dr. Robert McIntyre (Dr. Bob), not only for serving on my committee but for being a strong supporter of my efforts from the first day he arrived on campus. Your wit and friendliness have always lightened my day.

Dr. Ray Kirby (RK) has provided immeasurable support and encouragement from my undergraduate days at Old Dominion. Your calm demeanor and understanding have always been welcome spots during troublesome and confusing times. When I hear "ethics" mentioned, I think of you, not just because you taught the course, but because you can always be counted on for knowing the right thing to do. I hope I continue in your example.

Dr. Seth Zimmer, first a fellow graduate student, then a committee member, and now a colleague - what a wonderful word! Where would I be without your help and encouragement? We survived a lot of classes, tests, projects, and papers together. Your patience and support during my education and especially during the dissertation can never be repaid. I count myself fortunate to be considered a friend and look forward to meeting the newest Zimmer soon!

Dr. David Weston deserves a special tribute. Thank goodness you needed a root canal! Without your help I would never have found a study site. Thanks for smoothing out the wrinkles I created and for being such a strong supporter. May the surf always be up for you!

Many thanks to Jackie Winston and Mary Boswell, the backbone of the Psychology Department. Your friendliness and help have never gone unnoticed. All of the graduate students would be lost without your calm management of the bureaucratic mumbo-jumbo we are confronted with. Most of all, you two are always cheerful - bless you both.

Anne-Marie Yanufshefsky and Dr. Mic Fedorko deserve a note as well. Anne-Marie, thanks for your help at the beginning of this endeavor. I wish the best for you on your dissertation. Mic, thank goodness you were available for the final analyses so I could end this project. I am so glad you have SPSS!

Finally, individuals from the host organization deserve a special thanks. Thank you Lockett Garnett and Ned Harrelson for permitting me access to the construction department and for supporting the project. Thanks to Bo Roberts and Dave Hollomon for making as many allowances as possible to accommodate my needs. You were always curious, helpful and smiling - I really appreciate it. The foremen and construction team members were the joy of this project. You were all helpful, cooperative and so willing to participate. I sincerely hope the activities of this project continue to make your work easier and more enjoyable.

Heartfelt thanks to each and every one of you.

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IMPROVING TEAM PERFORMANCE
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A TRAINING STRATEGY

I. INTRODUCTION AND BACKGROUND

The improvement of group and team performance in organizations is always an important issue for study, although little effort has been made to enhance team performance at the organization's first line or primary level of production (first organizational level which has an identifiable product as its outcome). Beer (1980) notes that primary work groups (i.e, production or performance teams) are likely to be the most important subsystems within any given organization because they directly create the core products or services of the organization. These teams begin with raw materials and use tools and technology to transform them into an output (Hackman, 1990). Loss of production or poor quality of goods and services as a result of inadequate organizational policies, procedures and behaviors (including team behaviors) affect not only the competitive position of the organization but ultimately the job security and quality of life of its employees.

Due to the easily measured financial costs of taking these primary level groups and teams from the job at hand, management typically has not been enthusiastic about involving them in off-the-job team development activities and it is a rare occurrence for team members to be allowed

participation in such performance enhancing programs. A major challenge of the future, therefore, will be to find means of linking the conceptual theory for improving group outcomes to organizational activities aimed at enhancing performance that are regarded as practical at this level.

Until this point in time, research regarding group and team performance has largely focused on groups at levels of the organization other than the primary one. Examples are the Glickman, Morgan, Woodard, & Kirby (1985) and the Glickman, Zimmer, Montero, Guerette, Campbell, Morgan, & Salas (1987) studies of Naval teams; the Gersick (1988) time and transition research on project teams; the Gladstein (1984) model of group effectiveness based on sales teams; and the Rasmussen (1982) training with problem-solving groups. The purpose of the present research is to: (a) determine if procedures designed to foster improvements in team performance requiring limited time away from the task at hand would enhance group performance and various teamwork characteristics as well; (b) make recommendations for team training programs in this context; and (c) contribute data for multi-site reliability and predictive validity studies of teamwork measurement instruments (G. Varney, personal communication, March 5, 1992). Since groups at all levels of the organization contribute to organizational effectiveness (Hackman, 1990), this particular research on team performance of the primary work group seeks to provide

insight into methods that are appropriate and useful at this level of the organization.

Organization of Report

This first chapter discusses the need for research on group performance and its application at the primary level, defines teams, team performance and related concepts, presents conceptual models of both team performance (Nieva, Fleishman, and Rieck, 1978) and training design and evaluation (Muchinsky, 1990), describes the field setting and job requirements interaction, reviews strategies appropriate for enhancing team development, and puts forth the research hypotheses for this study. The second chapter addresses the details of this study's research design and methodology. Chapter three presents the results of the implementation of the team development strategies, and the last chapter discusses the significance of results as they apply to the hypotheses generated and offers recommendations for team training in this framework as well as suggestions for future research endeavors.

Work Groups and Teams

A variety of research endeavors have been undertaken in the domain of both group and team research. Hackman (1983, 1990) advises that work group and work team research be performed on "real groups" only. He identifies a real group as one with an intact social system (not a statisticized aggregation), with one or more group tasks to perform, and

that operates within an organizational context. Hackman (1990) also identifies a major problem associated with performing research on work groups: that is, the label "group" is so commonly used that it may refer to any of a variety of social or organizational units with vast differences in composition, communication and interdependence, including sports teams, social clubs, service providers and manufacturing and production teams. Steers (1984), focusing on group structure and processes, defines a group as a collection of individuals who share a common set of norms, have differentiated roles among themselves, and interact with each other to pursue jointly common goals. Huse and Cummings (1985) indicate that groups can be temporary or permanent and have four major components; task structure, composition, performance norms, and interpersonal relations. Cohen, Fink, Gadon, & Willits (1980) define the existence of a group by stipulating the size (2-15), the degree of differentiation from other groups, the existence of lengthy personal relations among members, the nature of individuals' identification with the group, and the occurrence of shared common goals among members. Walton & Hackman (1986) offer the following, adapted from Alderfer (1977): Groups in organizations exist if the group is perceived as such by both members and nonmembers, significantly interdependent relations occur among members, members' roles are differentiated within the

group, and the group operates in an organizational context. Frequently a group is defined in global terms -- two or more individuals interacting interdependently toward a common end (e.g., Boguslaw & Porter, 1962; Woodman & Sherwood, 1980b; Shuster, 1990). Other authors, (e.g., Porras & Berg, 1978; Blake & Mouton, 1981; Foxworthy, Ellis, & McLeod, 1982; Klein, 1985; Gersick, 1988), occasionally find the concept of a group to be sufficiently obvious to preclude the need for definition at all.

Total agreement does not exist regarding whether or not there is a difference between a "group" and a "team" due in part to the fact that many of the processes and dynamics in both are similar. However, a growing body of more recent research indicates that it is appropriate to define a team and differentiate it from a group, so for the purposes of this research a distinction will be made.

Hall & Rizzo (1975) indicate that it is frequently unclear whether the team is simply a collection of people performing individual jobs in a group context or whether there exists an identity over and above the composite of individuals in it.

Glaser, Klaus & Egerman (1962) offer the following distinctions between small groups and teams:

"Small groups" have the following characteristics:

1. They have an indefinite or loose structure, organization, and communication pattern.

2. They have assignments which are assumed in the course of group interaction rather than designated beforehand.
3. The group product can be a function of one or more of the group members involved depending upon the quality and quantity of their participation.

In contrast, "Teams" differ in that generally:

1. They are relatively rigid in structure, organization, and communication pattern.
2. The task of each team member is well defined.
3. The functioning of the team depends upon the coordinated participation of all or several individuals.

Nieva, et al (1978) maintain that it is more illuminating to describe teams by employing continua of a set of variables (e.g., amount of structure), rather than with categorical characteristics that describe what a team is or is not. They define a team as an entity with two or more interdependent individuals performing coordinated tasks toward the attainment of specific task goals. This definition implies that "co-action" alone (situations where individuals perform related tasks, but do not have to interact with each other to achieve common ends) does not define a team.

For Morgan, Glickman, Woodard, Blaiwes, & Salas (1986), who focused on the element of maturation over time and consequently most heavily stressed the component of team member interactions:

A team is a distinguishable set of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives.

Although this definition is very similar to the those for a group as cited previously, particular attention is called to the component related to individuals adapting to each other, which is stronger in teams than in some groups where there is less opportunity to interact in a pattern that requires dynamic adaptations to differing situations. It may suffice to say that the difference between "team" and "group" is mostly one of usage, where "team" is applied to groups which are constructed and trained to attain pre-established, purpose driven goals/objectives, whereas "group" often is used to refer to persons assembled with purposive intent or where role, method, and aims are more emergent as they evolve from the interactions of the persons involved. In effect, the distinction between a group and a team becomes one of the relative degree of adaptation, cohesion and interaction, where the lesser degree is appropriate for group behaviors and the greater for team behaviors.

Characteristics of Team Performance

Researchers on teams have examined various characteristics which typically have an effect on team performance. These characteristics include personal factors (attitudes, abilities, individual motives, personality and background), structure (size, work norms, and role and status relationships), group cohesion and interpersonal

relationships (e.g., Steers, 1984; Varney, 1989; Hackman, 1990), task work (e.g., Freeberg & Rock, 1987, and Glickman, et al, 1985), teamwork (e.g., Morgan, et al, 1986; Bucholz, Roth, & Hess, 1987; Kinlaw, 1991; and McIntyre, Glickman, Ruggeberg, & Yanushefski, 1991), team procedures, and leadership (e.g., Varney, 1989; Kinlaw, 1991). Team performance and its improvement remain the foci of much management and organizational research. Typically, these individuals are most interested in improving the effectiveness of performance of these work groups and teams. Improvement can be directed at all dimensions or characteristics of team performance; however, this particular research has as its foci the teamwork and taskwork variables of effective team performance.

Teamwork Characteristics. The previously mentioned elements of adaptation, cohesion and interaction as identified by Morgan, et al (1986), are part of an activity termed "teamwork." Teamwork is defined by McIntyre, et al (1991) as follows:

Teamwork is the set of values and behaviors necessary for a team to achieve its common goals and to adapt to the circumstances that it confronts in the work environment. Specifically, teamwork involves the following essential aspects:

1. The group's self awareness as an intradependent unit;
2. Overall team performance monitoring;
3. Feedback based on monitoring;
4. Closed-loop communication;

5. Backing-up behaviors.

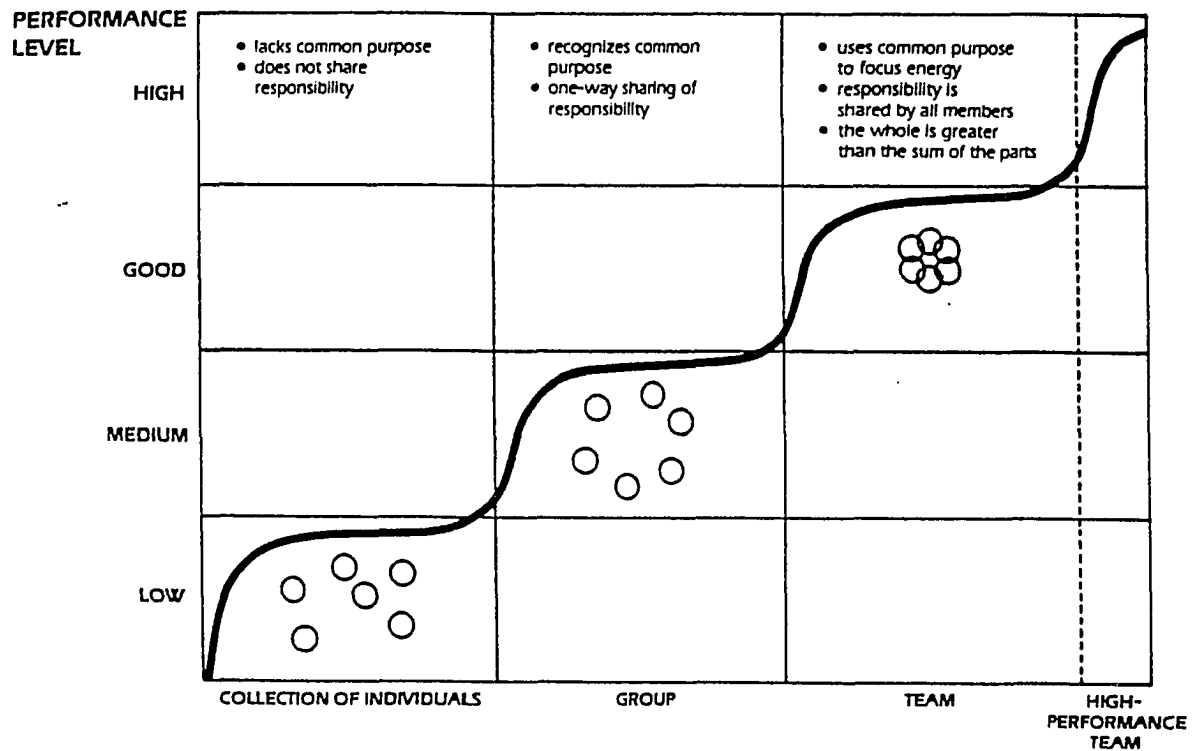
This definition implies that team members share a common frame of reference (the focus is on team performance and team outcomes when performing a task). The definition also implies that members monitor each others' performance out of concern for the welfare of the entire team; provide feedback to each other on the basis of what they have observed; engage in closed-loop communication (i.e., the team member sending the message ensures that the message is received as intended); and members back-up other members when necessary. I call special attention here to this last element of teamwork, because it is the behavioral outcome upon which the current research interventions are centered. Backing-up requires that the team consists of members who are sufficiently competent to perform or assist with the performance of the primary task of other members and do so. Examples of back-up behaviors are found in Navy team training situations (McIntyre, Morgan, Salas, & Glickman, 1988; and Peron, Blaksher, Zimmer, McIntyre, & Quinn, 1989) where Navy team training instructors identified the back-up behavior component of teamwork as those actions made by individuals in observing, assisting, making corrections, or offering suggestions regarding teamwork activities regardless of rank of fellow team members. Peron, et al (1989) found that although each specific behavior was not described by instructors monitoring the occurrence, or

possibility of occurrence, of these back-up behaviors, behavior attainment was positively correlated with higher end-of-training test scores.

Key teamwork activities as recognized by the Buchholz, et al (1987) diagram presented in Figure 1 also include shared responsibility and a common purpose. As a group of individuals becomes a team, it uses the common purpose to focus energy toward the goal and all members share responsibility of actions toward that goal. The Buchholz, et al diagram of Quality of Group Interactions shows low performance levels when a collection of individuals lacks common purpose and does not share responsibility; medium performance levels when a group recognizes a common purpose but has a one-way sharing of responsibility; and good to high performance levels when a team uses common purpose to focus energy, its members share responsibility, and the whole becomes greater than the sum of its parts. One can relate the McIntyre, et al (1991) teamwork component of back-up behaviors to the Buchholz, et al sharing of responsibility since back-up behaviors are likely the expression of perceived shared responsibility for the performance of the work unit.

Taskwork Characteristics. Taskwork or task characteristics also affect team performance. Freeberg & Rock (1987) indicate that a team's taskwork consists of the following dimensions: (1) complexity of the task or learning

Figure 1

Quality of Group Interactions

Bucholz, Roth, & Hess, 1987

the task; (2) task load (rate of presentation); (3) task fidelity (for use in non-field setting research - the comparability to the "real world"); (4) type of task structure (serial, parallel, additive, hybrid); (5) feedback/knowledge of results; and (6) imposition of goal or performance expectations.

Bass (1982) postulates a number of links between task performance and team performance since the task and technology of the team determine what a team can and does become as a group. He observes that as much as half the variance in team performance can be attributed to the task performance of the members, as individuals. Task performance of individuals may be due to the position to which they are assigned while team task performance may affect conditions imposed on the group.

Bass (1982) also identifies three types of interdependence, each requiring more coordination: pooled, sequential, and reciprocal. With pooled interdependence, each team member contributes to the whole and the whole supports each member. Coordination requires only standard routines. For sequential interdependence, one member's activities must follow another's. In addition to following standard routines, the team must plan and schedule for balancing of the component tasks. More communication among members is required for this level of activity. Finally, reciprocal interdependence requires even more coordination.

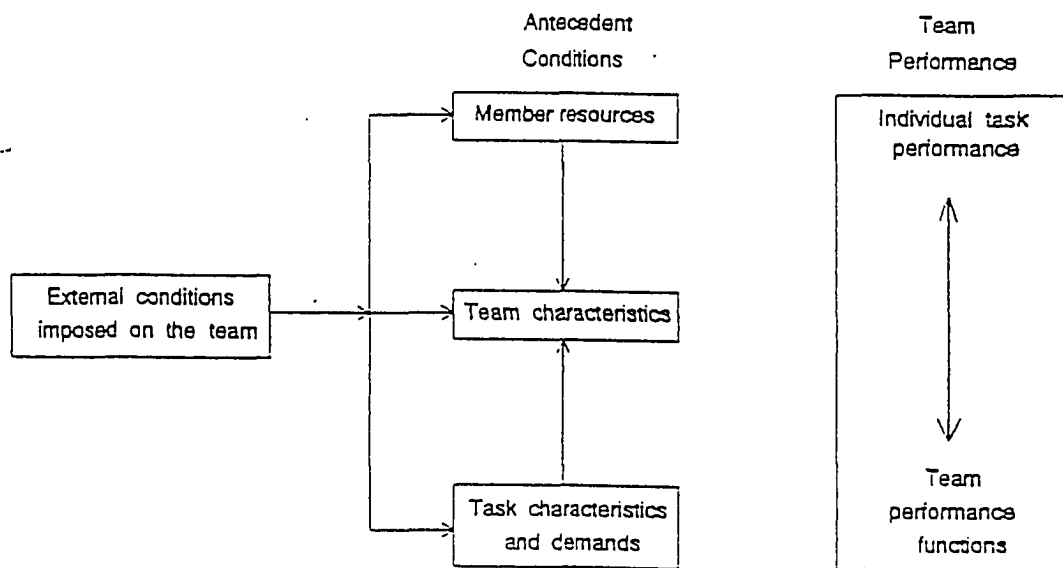
Mutual adjustment must be maintained in addition to standard routines, planning and scheduling and communication. A distinction between team and task oriented activities is made by Glickman et al (1985) whereby, although initially distinct and discrete, these activities become as one as the team develops and matures. For the mature or stable team, employment of the teamwork characteristics of overall team performance monitoring, feedback from that monitoring, closed-loop communication and backing-up behaviors as they relate to the task at hand serve to achieve that coordinated teamwork/taskwork activity necessary for accomplishment of team production goals.

Apart from defining team performance, theoretical models of team performance have been developed by researchers who strive to shed light upon the dynamic processes involved, their antecedents, and the results of team behavior. These theoretical presentations offer structure, focus and direction for new research examining team performance as well as enlightenment for those striving to understand the mechanisms and antecedents involved in group behavior.

Conceptual Model of Team Performance

One such model (see Figure 2) is that developed by Nieva, et al (1978) which has been influential in the study of teams (e.g., Glickman, et al, 1985; Morgan, et al, 1986; Goodman, Ravlin, & Argote, 1986). Although this particular

Figure 2

Conceptual Model of Team Performance

Neiva, Fleishman, & Rieck, 1978

model was used for development of a team training taxonomy, it is described in dynamic terms and illustrates that external conditions, member resources, team characteristics, and task characteristics and demands impact performance. Stipulation of external conditions gives recognition to the fact that most teams are part of a larger social system which has, to a considerable extent, determined the membership in the group, its structure, and the procedures which the group uses to accomplish its tasks. Member resources refer to the ability, motivation, and personality characteristics that each member brings to the task situation. The relationship between personality and performance may not be as strong or direct as that between abilities and performance. However, various personality traits such as sociability, task orientation and emotional stability may be thought of as general factors likely to influence performance, especially performance that requires cooperation among team members. Team characteristics refer to the authority structure of the group as well as its size, communication patterns, climate, and cohesion. This model suggests that team characteristics are also shaped by a number of factors including member resources, as well as task characteristics and demands that the external conditions impose upon the group. For example, the extent of homogeneity of the members (member resources) can affect the patterns of communication and cohesion (team

characteristics), and the size and structure of the group (team characteristics) might in turn affect levels of motivation (member resources). In the other direction, group size (team characteristics) may well affect coordination (a team task behavior) while the type of task (e.g., additive) may impact upon communication patterns (team characteristics) as well as motivation (member resources). All of these antecedent conditions interact to impact on the outcome of the team's effort - or team performance - by influencing individual task performance and overall team performance functions in conjunction with each other. Although not explicitly drawn on the model, a logical next step would be the product as the outcome of Team Performance. When describing their Team Performance model, Nieva, et al (1978) state:

The major components of team performance (individual task behaviors and team functions) determine the final team product, in ways which differ depending on the particular situation facing the team.

This outcome must be identifiable in some form, so that its acceptability is potentially assessable (e.g, quantity, quality or timeliness). In practice, the outcome may not literally be regularly assessed since it is only critical that the team produce some product recognized as its own. When the situation demands, it must be possible to measure and evaluate that product, even though formal assessment may not be made in every instance (Hackman, 1983, 1990). Bass

(1982) comments that the assessment of performance outcomes may be global or specific, objective or subjective, as long as it is the result of group (team) endeavor. Although not all parts of this model will be addressed by this research, it is presented here to provide the context within which this work is embedded.

There are a number of methods (with varying degrees of success depending upon the situation), which can be implemented in an effort to improve team performance, and hence improve quantity, quality or timeliness of production. These methods are typically referred to as intervention strategies; that is, planned change activities intended to assist an organization to become more effective (Huse & Cummings, 1985).

Team Development Strategies

Huse & Cummings (1985) place intervention strategies into four classes, within which the primary targets may be the individual, the group, and/or the organization. These four classes, include: (1) people and organizational processes, (2) technology and organizational structures, (3) human resource systems, and (4) strategy and environment. Since this research incorporates only those strategies designated for team development and individual improvement as it relates to the team processes, technology and organization structure and strategy and environment classes are not described in detail below.

People and Organizational Processes. People and organizational (also known as human-processual) interventions are directed toward individuals within the organization and their interaction processes. The underlying assumption here is that effective organizations are dependent on human processes and that when an organization experiences difficulty it may be as a result of critical human processes breaking down. Typical of some of these processes are communication, problem solving, leadership, and conflict resolution (Blake, Mouton, & Allen, 1987; Varney, 1989; and Hackman, 1990). Interventions designed for groups in this class might include t-groups, process consultation, third-party intervention, team building (Beer, 1980) and team development (Kinlaw, 1991).

Human Resource Systems. Human resource system strategies affect personnel practices of organizations. Personnel practices should respond to the needs and expectations of individuals within an organization. Expectations are part of the shaping of an individual's "psychological contract" with the organization (Schein, 1970); i.e, the individual will expect certain rewards in return for meeting certain organizational expectations (Beer, 1980). The underlying assumption here is that employee motivation is a function of those needs and expectations (e.g., expectancy theory and goal setting theory) as noted by Locke & Latham, 1990a; Locke & Latham,

1990b; Landy & Trumbo, 1989; Lawler, 1973; Vroom, 1964).

Reward systems, feedback on results, and goal setting would be likely interventions geared toward team performance in this class.

Selecting an Intervention Strategy. Intervention strategies must be tailored to each situation because it is important to recognize that no two circumstances are alike and therefore any intervention strategy must account for individual differences among organizations as well as the people within them. It accordingly becomes critical to select the strategy or strategies that are determined to be the most likely to produce successful results (Kotter & Schlesinger, 1979; Porras, 1979). Kotter & Schlesinger (1979) note that because planned change within an organization generally requires some kind of reorganization, there will occur a disturbance of the status quo which may pose a perceived threat to people and their vested interest in their jobs. One can therefore expect resistance, sometimes of sufficient intensity that the interventions are diverted, diluted, diffused, or deferred with a resulting loss in effectiveness. In order to allay this concern, Huse & Cummings (1985) recommend that certain considerations be taken into account when selecting intervention strategies for any situation. It is appropriate to query how the intervention will be implemented, if, and under which conditions, it will produce intended results. For example,

individual differences among incumbents (e.g., motivation and attitudes), certain organizational factors (such as managerial style and technology), and aspects of the intervention process itself (amount of management support) must be considered. It is also important to recognize that certain limitations may be placed upon the strategy selection process by the organization. For example, management might be willing to implement new strategies relating to reward systems but be less amenable to restructuring work groups. Certain constraints may already be placed upon the structure and interrelationships of individuals in work groups by the design of work flow and current technology of process or equipment.

One critical element of the intervention strategy implementation process is the determination of the needs of the organization. This may be addressed variously by means of interviews, questionnaires and surveys (Kotter & Schlesinger, 1979; Porras, 1979; Beer, 1980; Huse & Cummings, 1985). Based upon confirmation of the needs, an intervention strategy could then be decided upon by those individuals who would be involved in the processes or their outcomes (Goldstein & Associates, 1989). Three intervention strategies (team-building, feedback, and goal setting) were selected for the present research because they fit the needs (improving team performance), requirements (limited time away from the task), and constraints (labor laws and union-

management agreements) of the site organization better than other strategies. They are described in general terms below.

Team-Building. Woodman & Sherwood (1980b) state that team-building is an intervention designed to improve the effectiveness of a group of people whose jobs require that they work together. De Meuse & Liebowitz (1981) in their review of team-building results conclude that team-building is one of the most robust approaches to organizational development. In fact, many studies have reported positive outcomes arising from team-building activities (e.g., Beckhard, 1972; Nadler & Pecorella, 1975; Woodman & Sherwood, 1980a; Woodman & Sherwood, 1980b; Hughes, Rosenbach, & Clover, 1983; and Blake, et al, 1987). According to Huse & Cummings (1985), team-building interventions strive to improve the way that work groups accomplish their tasks and help group members to strengthen their interpersonal and problem-solving skills. Higher levels of motivation are frequently generated and specific problematic attitudes such as apathy, lack of interest and interpersonal conflict or hostility are diminished. Sometimes team-building activities are too successful. Boss & McConkie (1981) relate the incident of a team-building program that instilled higher group cohesion, but ultimately resulted in decreased performance because the "team" goal of unity superseded the organization's goal of performance.

Typical team-building activities have included data gathering, feedback and action planning (Woodman & Sherwood, 1980b); conflict resolution by confrontation (Kaplan, 1979); improvement in communications, role clarification, and member expectations through lectures, discussions and sharing of perceptions (Hughes, et al, 1983); participative goal setting (Beer, 1980; Hughes, et al, 1983); and periodic team meetings for problem-solving and self-regulation (Ends & Page, 1977). Kinlaw (1991) recognizes that authors who write about team-building and team development frequently use the two terms interchangeably (e.g., Dyer, 1977 and Varney, 1989). He describes some fundamental differences between team-building and team development. For example, team-building focuses on team deficits, whereas team development focuses on the team's positive opportunities for continuous improvement. Team-building is short term and intense. Team development, on the other hand, requires activities to be carried out over long periods of time and is therefore more diffused and ongoing, a part of the day-to-day work process. Team-building targets improving relationships of the team itself while the intent of team development is improvement in all organizational and team systems. He sees team-building to be only one aspect of team development.

Feedback. Defined as information provided to individuals about the quantity or quality of their past

performance (Prue & Fairbank, 1981; Balcazar, Hopkins, & Suarez, 1986), performance feedback is one of the more popular organizational behavior management (OBM) strategies to enhance productivity. Its primary advantages are its relatively low cost to organizations and its flexibility. With limited demands upon the organizational resources, information regarding performance can be given to individuals, or to groups, regardless of the context (e.g., individual performance within a group context). Performance feedback also infrequently requires extensive training and its implementation typically is clearly understood and has face validity for the recipients.

Prue & Fairbank (1981) also describe a number of feedback characteristics which should be considered when selecting a strategy of this type: 1) recipient of the feedback (should information then be public or private?); 2) the type of feedback mechanism (verbal, written, mechanical); 3) content of the feedback (e. g., comparison of performance to a standard or presentation of an individual's performance as some portion of the groups' total); and 4) feedback's temporal characteristics (when, how often, what duration?).

An example of a feedback strategy which has seen success in field settings is a posting of desired behaviors. For example, Anderson, Crowell, Doman, & Howard (1988) utilized individual behavior posting in a team context

(hockey) to achieve overall improved team performance, and Peron, et al (1989) utilized a similar procedure in Navy team training exercises to attain higher final exam scores. In the Peron, et al (1989) research, a proportion of desirable "occurred" behaviors to "could have occurred" behaviors for each team member (behaviors were not specifically identified) was posted in a place where all team members could see it. The teams were told that the information was for a research project, but team leaders on their own initiative frequently encouraged team members to increase the attainment of the designated behaviors as soon as possible.

Goal Setting. One of the variables affecting team performance and productivity is the presence or absence of a clear goal. Although it would seem obvious that all teams would have a goal, it is frequently the case that goals are taken for granted or members lose focus on the goal. For example, Larson & LaFasto (1989) have found that ineffectively functioning teams typically have some goal anomaly involved. Frequent anomalies are: goals that become unfocused or politicized; efforts that are diluted by too many competing goals; a lost sense of urgency to achieve the goal; and individual goals taking priority over the group goal. On the other hand, groups and teams that exhibit the most effective behaviors have been found to have "clear, elevating goals" (i.e., teams have both a clear

understanding of the goal to be achieved and belief that the goal embraces a worthwhile or important result).

Locke & Latham (e.g., 1984, 1990a, 1990b) have parlayed their research on goal setting as a performance intervention strategy into a motivational theory applicable to work motivation in organizations. This theory assumes that human action (albeit not all human action) is directed by conscious goals and intentions. Choice of the word "goal" arose from a desire to focus on the desired end-result rather than the behavior itself or intended behavior (Locke & Latham, 1990a). The fundamental question they address is: What is the relationship between goals and action or goals and task performance?

An interesting aspect of goal setting theory is that its antecedents occur in both the business world (management theory) and academic world (experimental psychology). One of these theorists is more comfortable in the domain of laboratory experiments and theory development, while the other is more at home conducting field experiments and applying psychological theories to work organizations. The combination has produced a theory with strong practical applications in a wide range of organizational settings. Locke & Latham (1990b) see the roots of goal setting theory as planted by the Wurzburg school in Germany in 1900 with the definition of "task" as a piece of work to be accomplished. Ryan (1970) added "intention" to the

between effort and performance, researchers attempt to specify goal conditions that will increase the individual's exertion. Therefore, goals that are clearly stated, specific, and difficult (but not unobtainable) will, if accepted by the individuals, generate added effort, leading, in turn, to improved performance. Conversely, performance will be adversely affected by absence of goals, or by nonspecific ("do your best") or weak goals (Siegel & Lane, 1987; Tubbs (1986); Huse & Cummings, 1985). Bandura (1987) and Landy & Trumbo (1989) share the concern that goal setting results found in laboratory settings may not generalize well to field settings since there are differences in duration of effort required, failure costs, and opportunities for alternative actions. The strength of the relationship between goals and performance may be mediated by various environmental constraints (Landy & Trumbo, 1989). Locke (1968) does not deny that task characteristics, feedback, incentives and style of supervision also affect performance, but states that the goals an individual sets can influence this relationship.

Locke, Saari, Shaw, & Latham (1981) summarize most of Locke's findings in the following statements. (1) Goals influence task performance by focusing attention and action as well as enhancing energy. This energy is then prolonged over time and helps individuals to develop strategies to achieve goal accomplishment. (2) Feedback regarding

performance relative to the set goal is a factor in maintaining a high level of effort. (3) Goal setting is most likely to have its intended effect when a reward of some sort follows achievement of the goal.

Locke & Latham (1990b) indicate that although participation in goal setting has been followed by marked performance improvement in some situations, it is not always necessary to have individuals share in the formation of goals and standards. Equally significant results have been found in settings where obtainable but challenging goals were set by supervisors. Perhaps more important in these situations, was the understanding and acceptance of the goals by the individuals involved.

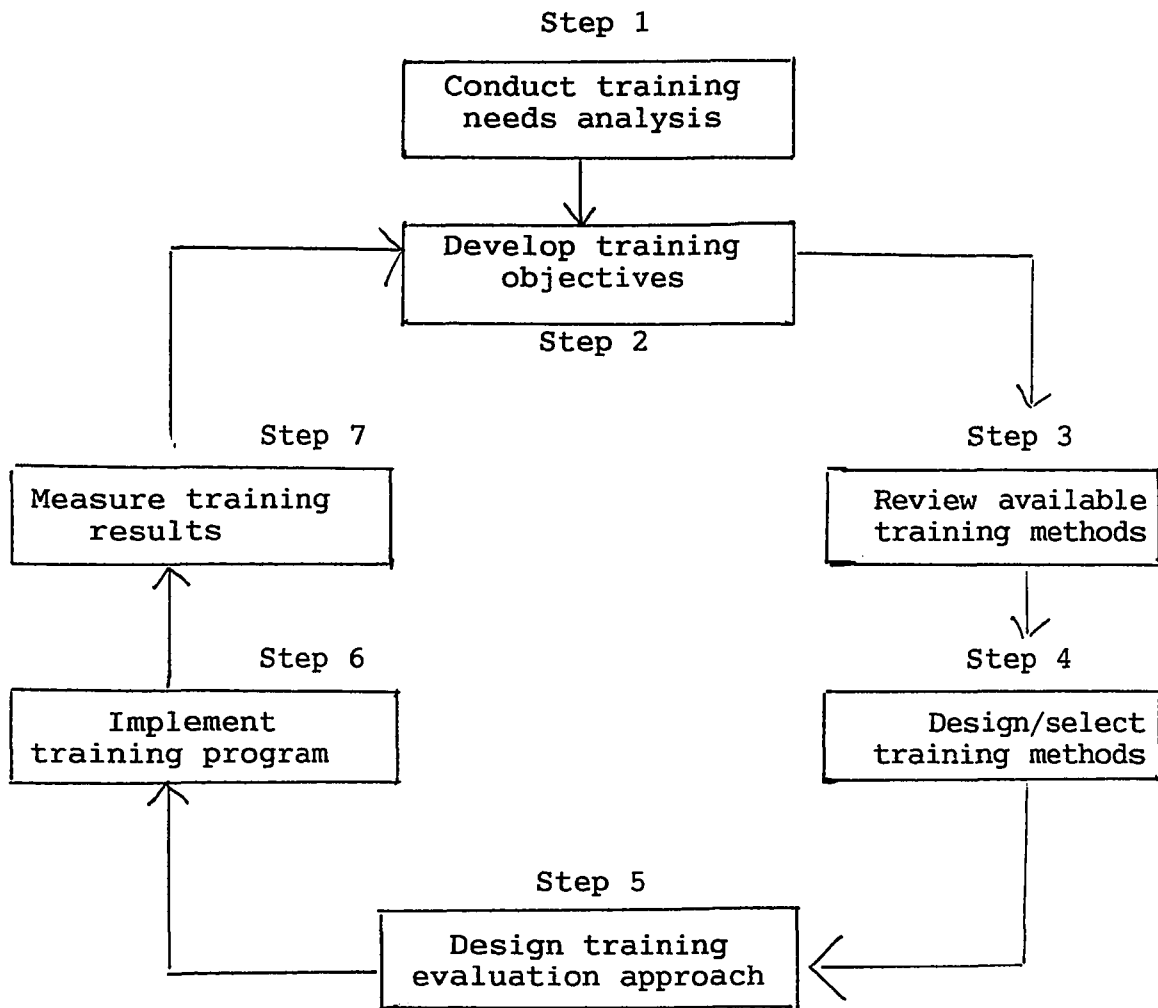
All of the above-mentioned intervention strategies require some vehicle of presentation to the individuals (or work groups) in an organizational setting. One such vehicle for presentation is a training format. Training and instruction have been one of the most commonly cited interventions to improve productivity (Katzell & Guzzo, 1983), perhaps because they frequently incorporate other intervention strategies in the process (e.g., goal setting and feedback). A training format in the work setting might utilize workshops or sessions designed to present appropriate information, practice activities, involve team members, and foster desired behaviors. Garvin (1993) in describing the importance of training in the working world,

describes the steps needed to become a "learning organization" and foster improvement. As a first step, the new idea is presented to the members of an organization so that they begin to think differently. The second step is the identification and acquisition of new behaviors associated with the concept. The third step is improvement in performance with changes leading to measurable improvements (quality, quantity, etc.), and the fourth step involves some form of measurement of effects (e.g., surveys, observation, objective or subjective measures of production). Evaluation of effects induced by the various strategies can then be used to modify future training efforts (Goldstein & Associates, 1989). Muchinsky (1990) offers the following diagram (see Figure 3) to illustrate the type of framework to be followed when developing and implementing a work-related training endeavor for an organization. The elements of this diagram (**bold face type**) are reflected in the following general discussion of training and development.

Training

According to Wexley & Latham (1981), training and development is a planned effort by an organization to facilitate the learning of job-related behavior on the part of its employees. "Behavior" is used in its broadest sense and refers to any knowledge or skill. Team training, according to Bass (1982) is a condition imposed on teams

Figure 3

Training Design and Evaluation Model

Muchinsky, 1990

that may have direct impact on the team's interaction processes and therefore team productivity. He therefore advises that in order to facilitate team interaction, team training should depend on a diagnosis of the team's interactive problems (**Step 1: Conduct a training needs analysis**).

Morgan, Salas, & Glickman (1987), drawing conclusions from research with navy teams, suggest that teamwork training should become a formal part of the training process. This recommendation was supported by subsequent Navy research (anti-submarine warfare teams) by McIntyre, et al (1988). Further, Varney (1989) concurs with both Morgan, et al (1987) and McIntyre, et al (1988) in that different teams start with different levels of teamwork skill competence and therefore an initial part of training should be set aside for assessing teamwork skills (e.g. via a teamwork survey or questionnaire). In other words, unless we understand where a team stands in relation to teamwork competency, we will be unable to optimize the learning that should take place during training programs and determine the desired training outcomes (**Step 2: Develop training objectives**). Although the organization involved in the research here is interested in promoting improved team performance through enhanced performance, management is also concerned about developing training for new team members that will enhance their teamwork skills at an earlier stage

in employment. The organization can expect to benefit from increased awareness and acquisition of teamwork skills by new employees when joining gas worker teams.

Maximizing Learning. A first consideration when designing a training program is the method of presentation. Muchinsky (1990) organizes training methods into two categories of on-site and off-site training which are briefly described here. On-site methods include on-the-job-training (learning occurs by imitation), vestibule training (equipment close to but not involved in actual production), job rotation (learning by doing other jobs), and apprentice training (learning by assisting the "instructor"). Off-site training methods typically include lectures (one-way communication from instructor to an audience), audio-visual material (films, slides, videotapes), programmed instruction (self-paced instruction via a piece of equipment or book), computer-assisted instruction (extension of programmed which allows some difficulty variability), and conferences (two-way communication utilizing discussion, such as a workshop).

Certain other considerations regarding learning (such as transfer, length of practice/learning session, meaningfulness, and feedback and reinforcement) must be accounted for when designing a training program for presentation in this context (Robinson & Robinson, 1989; Wexley & Latham, 1981). Since there is little utility in a training experience that does not carry over to the job

situation, a first consideration is transfer of training. Transfer refers to the extent to which what was learned during training is used on the job and Wexley & Latham (1981) offer a variety of suggestions to accomplish this goal. Among the suggestions applicable in this context are: (1) providing a variety of examples, (2) maximizing the similarity between the training situation and the job situation, (3) labeling important features of the task, and (4) designing a content that is relevant to the trainee so that he can see the applicability to the job.

Kinlaw (1991) notes that team-building sessions typically consume hours or days based on the concept that it should be intense and solve all interpersonal problems. He suggests that shorter recurring sessions, that focus on positive rather than negative aspects of team behavior would be more useful. This is in agreement with the idea that distributed practice provides for more efficient learning of skills than massed practice (Landy & Trumbo, 1989; Wexley & Latham, 1981).

Another important factor is that when material to be learned is meaningful to trainees, it will be more easily remembered (McGehee, & Thayer, 1961). Wexley & Latham (1981) indicate that material that is rich in associations for the trainee is easily understood and therefore remembered by them. Utilization of typical team-building "games" (e.g., building towers out of Tinker Toys or

participating in computer games) are not applicable in all work settings because they are not meaningful to the individuals involved (Broadwell, 1993). In addition, findings by Rasmussen (1982) indicate that groups should be trained individually toward mastery of a set of skills rather than competitively, since the competition either detracts from the learning objective or reduces willingness to participate.

Feedback has been identified as a key feature in any training situation (e.g., Robinson & Robinson, 1989; Goldstein and Assoc, 1989). Wexley & Latham (1981) state feedback has three important functions in promoting learning and motivation to perform; 1) feedback conveys information to trainees about correct responses so they can make necessary adjustments to subsequent behavior, 2) feedback makes the process more interesting and thereby maximizes the willingness to learn, and 3) feedback leads to setting of specific goals for maintaining or improving performance. In addition, feedback serves to reinforce the desired behavior (e.g., Anderson, et al, 1988). Feedback therefore, serves two functions in a training situation (maximizing the learning experience and reinforcement of desired behaviors) and as a result is an important consideration when developing a training design.

In summary, for this particular population of team members and within the constraints of this organizational

setting (primary production level), a conference-type workshop or training session of short duration that focuses on teamwork skills that are salient and job-related and incorporates a goal setting and feedback reinforcement strategy would be an appropriate selection for implementation (**Step 3: Review available training methods** and **Step 4: Design/select training methods**).

Evaluation. Finally, a number of individuals (e.g., Goldstein & Associates, 1989; Robinson & Robinson, 1989; Muchinsky, 1990) stress the importance of not only pre-assessment or diagnosis of skills (team or otherwise) but evaluation of training programs after the process has been completed (**Step 5: Design training evaluation approach**). A number of training evaluation criteria should be addressed at this juncture. Kirkpatrick (1976) identifies four criteria appropriate to evaluation of training programs of this type; reaction, learning, behavioral, and results.

Reaction criteria are the participants' reactions to the training. Viewed as a measure of face validity (judgement of the participants regarding appropriateness of the training), an evaluation form is typically used to assess reactions.

Learning criteria, when used, refers to evaluating how much was learned in the training program. Tests can be given following programmed instruction in some cases, however when training is directed at changing attitudinal

skills, formal evaluation is more difficult. Since there is an established link between attitudes and behaviors (e.g., Fishbein & Ajzen, 1975; Zimmer, 1990), this would be an important criteria for measurement. The same measurement device used to diagnose teamwork skills would likely provide insight post training as well.

Behavioral criteria are the actual changes in the participants' performance back on the job. Bass (1982) describes typical measures of team performance as global or specific, objective or subjective, and the product of single members or the pooled product of all team members just as long as the product represents a joint team performance effort of two or more members.

Results criteria refer to the ultimate value of the training program to the company or organization involved. They require comparison of the costs of the training program to its benefit and are the most important as well as the most difficult to develop. All costs must be considered including time away from the job, materials, and trainer time, and compared to increased production output or employee "better attitudes." This would produce a utility measurement that reflects the benefit to the organization of having a more productive work force versus the cost of the training. Obviously, measuring results at this point can be exacting, especially where attitudes are considered. The training program to be developed here has only lost

production time for team members and foremen as its cost. Recommendations for future training would have to account for trainer time and material costs as well.

The remaining two steps of this cyclical design (**Step 6: Implement training program** and **Step 7: Measure training results**) along with their impact on Step 2 (**Develop training objectives**) remain the second objective of the research undertaken here. Following presentation of the team-building workshops (**Implement training program**), certain measures including observations of behaviors, subjective assessments of team performance, participant evaluation of the training program, and assessments of team member responses regarding teamwork skills (**Measure training results**) are planned to derive recommendations regarding future training programs (**Develop training objectives**). Since this particular company does not record objective production data per team, results criteria (Kirkpatrick, 1976) are addressed in terms of qualitative benefit to the organization.

Site and Job Characteristics

The site under study is a public utility providing installation, service and repair of natural gas facilities to commercial/industrial buildings and private residences in Southeastern Virginia. The communities served are Chesapeake, Norfolk, and Virginia Beach. The teams involved in this research are the "gas workers" (construction) or

installation and repair teams at the primary level of the organization. All team members are unionized and research must therefore fit parameters of involvement with the employees that are subject to approval by the union as well as management. Due to the demands of safety (for team members as well as the public at large), constraints of labor laws and labor-management agreements, and the need for profitability, management continues to seek cost effective methods for improvement of team activities with the desire for increased overall quality and quantity of production performance at this level of the organization; hence the company's interest in this particular research.

Teams are assigned a job (e.g., install new service, retire old service, repair service, locate and repair leaks) and are expected to have sufficient equipment and tools on the truck to carry out the duties. All team members ride together in a construction vehicle that usually also pulls a trailer with either a trencher or bulldozer/backhoe. The work involved in natural gas construction is typically physically demanding and requires a variety of task skills. All activities occur out-of-doors, regardless of temperature and weather conditions (although non-emergency work is not performed in the rain), require either hand digging or operation of bulldozers/backhoes and utilization of heavy hand equipment including thumpers, jackhammers, 10 lb wrenches, etc., and frequently necessitate performing the

task crouched inside a hole. It is also necessary that team members know how to work with a variety of tools and types of gas lines. For example, 100 years ago, Norfolk's main lines were made of wood. Some of these still exist as do pipes made from iron, galvanized steel, copper and plastic. Each type of pipe requires different equipment, tools and method for repair or joining of new installations. Frequently, problem-solving skills are needed to locate reported leaks, old service lines and other underground utilities.

Added to this variety of task dimensions and physical requirements is the overriding possibility of fire and explosion due to leaking gas, ruptured lines, or improper installation. Since natural gas lines are located underground and frequently have major source lines under roadways, there is an added element of traffic danger and the requirement to accommodate that traffic insofar as possible (e.g., the organization can be fined by the local bus authority if bus routes are delayed for too long a period of time). Safety rules and requirements are at times burdensome, but obviously necessary.

Definitions Pertinent to this Research

Team. In agreement with Hackman's (1990) definition of work groups, these teams are "real" groups with intact social systems (with boundaries) whose members have differentiated roles and display interdependence. Each team

has one or more tasks to perform for which members are collectively responsible and whose outcome can be identified and assessed. These tasks fall into reciprocal interdependencies as identified by Bass (1982), since completion of a task requires the coordinated efforts of two or more individuals. For example, finding and repairing leaking gas under a major street without digging up all the pavement requires at least the following; coordinated problem solving to determine the leak's "line of least resistance," coordinated effort to find its source, watching and warning of traffic, assisting with suggestions for digging without disturbing other utilities (water, phone, electrical, sewer), helping with digging, determining appropriate type of repair, repairing without causing explosion or fire, and restoring the area to its previous condition.

Also according to Hackman (1990), the teams operate in an organizational context as part of a larger socio-technical system and have contact with entities beyond their boundaries. These teams are the primary level of the construction department which is responsible for installation and repair of all services. They must interact with material and equipment supply, engineering and plotting systems, official city inspectors, members of other utility operations, organizational management, union peers and management, and the public.

In addition and in further agreement with Morgan, et al (1986) these teams comprise a distinguishable set of two or more individuals who interact interdependently and adaptively to achieve specified, shared, and valued objectives. Although in this particular setting, one member is designated the team leader, his role is largely one of guidance and coordination since he has the most training and experience. The team leader makes no appraisal, promotion, demotion or hiring decisions (role of the foremen) and therefore remains part of the team rather than its supervisor. The team is responsible for not only completing the job, but for keeping the repair truck stocked and in good repair as well.

Finally, observation of team performance illustrates that these teams display those teamwork characteristics described by McIntyre, et al (1991) in that 1) the group has self awareness as an intradependent unit; 2) there is constant team performance monitoring (completion of numerous steps in order to achieve task completion; 3) feedback occurs based on monitoring (e.g., emergence of gas smell or water bubbles (bubble test for leaking joints, etc.) indicating incomplete repair); 4) members participate in closed loop communication (e.g., when assisting with digging by hand or backhoe, requesting tools, warning of potential safety issues); and 5) backing-up behaviors are necessary in most task situations (e.g., offering suggestions for

location of a leak, monitoring safety and traffic).

In summary, the teams for this research are real, intact groups of two or more members who have self awareness as an intradependent unit and interact adaptively and cohesively by employing individual task performance and such teamwork characteristics as team performance monitoring, feedback based on monitoring, closed loop communication and backing-up behaviors in order to achieve a shared and valued goal (completion of the task in a safe and timely manner).

Team Performance. Based on the Nieva, et al (1978) research and model, team performance is the interaction of individual task performance and team performance functions. Individual task performance consists of those actions necessary to perform the jobs of leak detection and repair, installation and retire of natural gas service equipment (Nieva, et al, 1978; Varney, 1989). Team performance functions include those behaviors at the team level necessary to complete the task, such as coordination and other interactions (Morgan, et al 1986). Team performance leads to an outcome that is assessable by whatever means. Typical of these outcomes are quality, quantity, and timeliness which do not have to be measured every time (Hackman, 1990). In this situation, team performance will describe the teamwork aspects necessary to produce an outcome and that outcome as well.

Teamwork Characteristics. Teamwork

characteristics include dimensions of leadership such as participation, interpersonal relations such as loyalty and trust, team processes such as communication and resolving conflict (Nieva, et al , 1978; Varney, 1989), task (Glickman, et al, 1985; Varney, 1989; Hackman, 1990) and back-up behaviors such as helping locate a leak through problem-solving (Peron, et al, 1989; McIntyre, et al, 1991). Although leadership is not addressed by the present research, interpersonal relations, team processes, and back-up behaviors as they relate to teamwork and taskwork are explored. Particular attention is focused on the back-up behaviors required to perform as a team in this context.

Back-up Behaviors. Back-up behaviors include those assisting actions by team members toward other team members that require anticipation or adaptation such as providing corrections, tools and materials as needed, safety warnings, suggestions for problem-solving, and guidance (other than instruction) and that ultimately help to improve team performance.

Product/productivity. The product is the completion of a job, e.g., installation of one service or the finding and repair of a leak. The product must be assessable, even if not assessed each time (Hackman, 1990). Typical assessments or measures of productivity include quantity, quality and timeliness (Hackman, 1990; Varney, 1989). For this research, the quantity, quality, and

timeliness outcomes are subjectively assessed by the foremen (supervisors) from their responses to a performance questionnaire (developed by Varney in 1990).

Training Workshop. The training workshops are planned efforts by this researcher on behalf of the organization to facilitate the learning of job-related behavior on the part of its employees (Wexley & Latham, 1981). This training takes place in the team context because team training, according to Bass (1982), should be the condition imposed on teams in order to have direct impact on the team's interaction processes and have an effect on team productivity. Since Glickman, Zimmer, Montero, Guerette, Campbell, Morgan, & Salas (1987) argue that an organization's misplaced faith in "natural" evolution of teamwork skills results in wasted time and resources, effort is made to train for teamwork skills by focusing particular attention on the characteristic of back-up behaviors.

Design of training workshops is dependent upon diagnosis of each team's interactive problems (Bass, 1982; Varney, 1989), the needs of the organization (Wexley and Latham, 1981; Robinson & Robinson, 1989), and the limitations placed on strategies by the organization (Kotter & Schlesinger, 1979; Huse & Cummings, 1985). In order to pass the behavior change threshold for assessment of team performance, a cumulative effect of several interventions may be required (A. S. Glickman, personal communication,

March 16, 1992). These interventions are defined below in the context of this endeavor.

Team-building. Team-building is an intervention designed to improve the performance of teams whose jobs require that they work together (Woodman & Sherwood, 1980b; Bass, 1982). As a component of this study, it includes defining teams and describing healthy versus non-healthy work groups in order to foster affiliation and understanding within the team. Identification of back-up behaviors for each team (those behaviors which assist fellow team members in the achievement of the intended task, as seen in McIntyre, et al, 1988; Peron, et al, 1989) will be utilized in both team-building and non-team-building activities.

Goal Setting. Goal setting is a method by which clear and stated back-up behavior objectives are defined for the group and commitment to the end result is sought (Locke & Latham, 1984; 1990a; Larson & LaFasto, 1989). Goal setting takes place during the team-building process and requires that team members set personal goals for attainment of newly identified back-up behaviors (e.g., offering suggestions for location of leak).

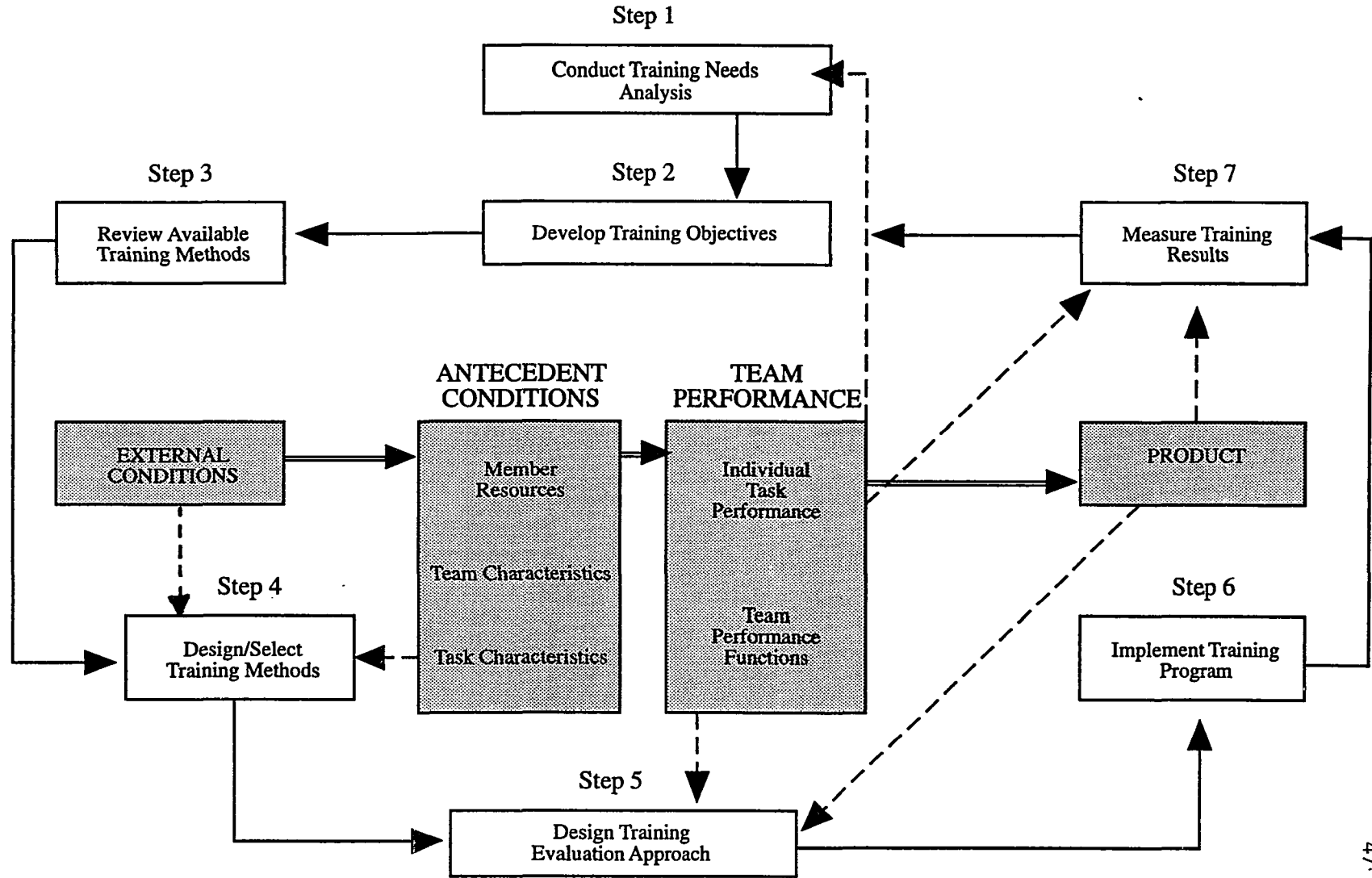
Posting Strategy. This type of performance feedback utilizes the Anderson, et al (1988) technique of posting desired behaviors so that team members will become aware of their performance progress in certain areas. Posting of back-up behaviors is the focus of this strategy

that calls attention to individual behaviors which provide back-up to other team members in the team/task framework. The information above is observed in the team context and recorded for each individual. Feedback regarding attained and missed opportunities to back-up fellow members is shared with the team member only, who retains a copy of the posting.

Research Hypotheses

This research had three main objectives. First, it was undertaken to determine the feasibility of implementing procedures designed to foster improvements in team performance which require only a relatively short time away from the job. Second, it was undertaken to develop a training program to demonstrate feasible procedures in this context. Third, it was undertaken to provide data as part of a multi-site reliability and predictive validity test of two team performance measurement instruments. The following diagram (see Figure 4) is presented to illustrate the thrust of this research by focusing particular attention on those elements of team performance that are hypothesized to reflect changes induced by a training intervention utilizing team-building, goal setting and feedback. This diagram is adapted from the Nieva, et al (1978) conceptual model of team performance (see Figure 2) and the Muchinsky (1990) training design and evaluation model (see Figure 3), but more clearly illustrates the dynamic link between team

Figure 4 Training Model Adapted to Team Performance Model



performance and its outcomes as well as the expected impact of the training process.

In order to accommodate external and antecedent conditions imposed upon the team, the direction of the training design and evaluation model is transposed. Please note that all steps are followed in the same order, but in a counter clockwise direction. Although there exist other team training models (e.g., Morgan, et al, 1986), this particular adaption is deemed to provide focus for the elements which reflect the organization's objectives of cost-effective training in this unique situation with pre-established teams at the primary production level. Examination of the adapted model indicates that team performance impacts the needs analysis (Step 1). Training objectives (Step 2) are derived from the needs analysis and then available methods are examined (Step 3) and selected (Step 4) based upon the antecedent conditions and external constraints placed upon the teams and the training process by the organization (and society in general). Step 5 demands the design of a training evaluation approach that considers team performance and product output. After implementation of the training program (Step 6) measures of training results are derived from the product and team performance and compared to the original objectives. If necessary, the entire evaluation process can be repeated with modifications in order to continue to attain desired

objectives. In keeping with the objectives of both this study and the site organization and based on the previously cited research, team performance and training evaluation models, the following hypotheses were formulated:

Objective 1: Improving Team Performance

Hypothesis 1: Back-up behaviors increase for those teams experiencing the team-building, team-building-with-posting and posting-only interventions. If they are salient and job-related, teamwork applications that are presented in a conference-type atmosphere of short duration can be transferred more easily to the job at hand, especially when feedback is involved. Identification of specific back-up behaviors provides salient, job-related information for team members to use.

Hypothesis 2: There is no perceived improvement in teamwork characteristics (other than back-up behaviors) for teams presented with only the team-building intervention. Increased awareness of interpersonal relationships, leadership, and better communication require a two-to-three day setting in order to foster stronger affective attitudes toward continuing as a group member and improve general feelings toward interpersonal, leadership, and team process issues.

Hypothesis 3: Perceived improvement in teamwork characteristics (other than back-up behaviors) does not occur for those teams presented with the posting-only

intervention. As stated above, establishing the link between improvement in teamwork characteristics and improved performance requires more than introduction of the concept of back-up behaviors even with attendant feedback.

Hypothesis 4: Perceived improvement in teamwork characteristics (other than back-up behaviors) by team members does occur for those teams presented with the combination of team-building, goal setting, and posting interventions. Knowledge of clearly stated goals and presumed commitment to them yields positive results regardless of whether the goals are imposed or participatively generated. The goals create a benchmark to be striven for by participants. Goal setting strategies can be utilized for teamwork behavior (back-up behaviors) as well as task behavior acquisition.

Hypothesis 5: Productivity as defined by quantity, quality, timeliness, and overall team performance does not increase for teams presented with only the team-building intervention. Production outcomes improve with the enhancement of processes required for teamwork, namely communication and back-up behaviors if team-building activities consume two-to-three day workshops. These teamwork enhancements cannot be absorbed in a short period of time without the aid of other reinforcers.

Hypothesis 6: Productivity as defined by quantity, quality, timeliness, and overall team performance

does not increase for those teams presented with the posting-only intervention. Even though the posting strategy provides feedback for specific and appropriate targeted behaviors, feedback and discussion of back-up behaviors alone are insufficient to produce changes in overall performance.

Hypothesis 7: Productivity as defined by quantity, quality, timeliness, and overall team performance does increase for those teams presented with the combination of team-building, goal setting, and posting interventions. Combining the three strategies provides team members with the necessary teamwork tools to perform as a team more efficiently, as well as offering goals for teamwork enhancing skills by cuing and reinforcing those skill behaviors, and hence leading to improved performance.

Objective 2: Training Program

Hypothesis 8: Evidence demonstrates that a training program incorporating explanation of back-up behaviors which utilizes goal setting and posting strategies for acquisition of behaviors can be developed for new team members. Based on evaluative criteria from participants, results of observed behaviors, subjective impressions of overall team performance, assessments of teamwork attitudinal changes, and determination of qualitative benefit to the organization, development of a training protocol that reflects the objectives of the organization is

feasible.

Recommendations derived from results of the teamwork measurement instrument is useful for the development of ongoing team-building interventions (workshops) to improve overall team performance by enhancing teamwork characteristics.

Objective 3: Reliability and Predictive Validity

Tests.

Information obtained from two of the data collection instruments will contribute additional psychometric support to the ongoing multi-site testing of those instruments (instruments are described in the Methods chapter). A frequent criticism of field research is the lack of a large population from which to sample. Sharing of data and information provides a unique contribution to an effort of national scope at greater statistical and experimental control with application to real, functioning work environments.

II. METHOD

Participants

The participant population for this study consisted of 37 male and 1 female gas workers comprising 13 teams in the construction department. Ages ranged from 21.42 to 62.66 years (\bar{M} = 32.75; \underline{SD} = 6.89). Length of service in the job ranged from .166 to 37.33 years (\bar{M} = 7.55; \underline{SD} = 8.27). Two of the 13 teams were made up of 2 members, the 11 others of three members. Due to the physical demands of the job the female transferred to another department and was replaced by a male (\underline{n} = 37). Participants of one team were inappropriately exposed to the back-up behavior concepts and that team was therefore eliminated from the final analysis (team \underline{n} = 12, participant \underline{n} = 34). Management and the union representative were instructed that participation was voluntary and any participant was free to decline or avoid active participation at any stage of the study. That option was not exercised by any of the individuals involved.

Recruitment of Participants

Initial contact with the company was in response to expressed interest by its industrial/organizational psychologist (Administrator: Human Resources) in a teamwork study. Because of the prevalence of teams at the primary level in this company (the gas workers), enhancement of team performance remains a goal for management. Explanation of the concepts driving this project (specifically goal setting

and posting of back-up behaviors) to the human resources administrator was followed 10 days later by a meeting with the vice president of the company and his immediate subordinate (manager of the construction department). Again the concepts involved, as well as the amount of participation required of the team members and their foremen, and the data collection forms which would be used were explained (see Appendix A). This explanation included a copy of the Teamwork Survey (Varney, 1989). Management requested that the title of the survey be changed to Teamwork Checklist, since the term "survey" had previously met with resistance by union management (and that title will be employed hereafter). They also requested that results of the checklist be used to assign teams to team-building workshops to better utilize the experience for those requiring it and that presentation of the checklist and workshops be done on inclement weather days (to reduce time off the job). Hughes, et al (1983) state that even with constraints placed by host organizations upon field research, results are more generalizable to other real world settings than are laboratory simulations. In addition, the researcher must account for the needs of the host organization (Hakel, Sorcher, Beer, & Moses, 1985). The result of this meeting was to apprise the two directors of construction (direct subordinates of the manager of construction) of the processes involved in performing the

research and to seek their approval and commitment of support. They were very receptive to the objectives and processes of the research project.

This researcher was then encouraged by management to return to the site the following morning and join two of the foremen of the gas worker teams on their "rounds" in order to determine the feasibility of identifying back-up behaviors. Two days were spent observing team interactions, identifying a few appropriate behaviors, and becoming acclimated to the requirements of the job. Several possibilities (such as offering to take over digging, passing shovels and repair tools, securing safety equipment, offering suggestions for repair, etc.) were immediately noticed as possible back-up behaviors. One week later, with the approval of management, the human resources administrator and this researcher met with the six foremen (immediate supervisors) of the gas worker teams to explain the concepts, elicit their support and assistance, and answer questions. The outcome of this meeting was positive and, upon notification to union officials, the project proceeded.

Research Design

The design of this study is presented in Figure 5. This study utilized a mixed model factorial design that crossed two levels of team-building (team-building, no team-building) with two levels of posting (posting, no posting)

Figure 5

Research Design

		TEAM-BUILDING	
		Team-building	No Team-building
TIME 1	Posting	Team \underline{n} = 3 Indiv. \underline{n} = 9*	Team \underline{n} = 3 Indiv. \underline{n} = 9**
	No Posting	Team \underline{n} = 3 Indiv. \underline{n} = 9 [^]	Team \underline{n} = 3 Indiv. \underline{n} = 7 ^{^^}
TIME 2	Posting	Team \underline{n} = 3 Indiv. \underline{n} = 9*	Team \underline{n} = 3 Indiv. \underline{n} = 9**
	No Posting	Team \underline{n} = 3 Indiv. \underline{n} = 9 [^]	Team \underline{n} = 3 Indiv. \underline{n} = 7 ^{^^}

Team \underline{N} = 12
Individual \underline{N} = 34*[^]

* Back-up behavior Individual \underline{n} = 18

** Back-up behavior Individual \underline{n} = 18

[^] Back-up behavior Individual \underline{n} = 18

^{^^} Back-up Behavior Individual \underline{n} = 14

*[^] Total Back-up behavior \underline{N} = 68

as between variables with two levels of time (time 1 and time 2) as within variables.

Team member responses to the Teamwork Checklist (Varney, 1989), supervisor responses to the Performance Indicator (Varney, 1990), and field observations of back-up behaviors served as dependent variables.

Identifying the Teams

Due to emergency night and weekend activities (broken lines or leaks), training, and vacation or sick time, teams are frequently reconfigured in order to maximize daily objectives (from once a week to several days). The "normal" or most frequent arrangement of a team, however, was identified by each foreman for the purposes of this research. This configuration was then used throughout the study for all data collection and intervention activities.

Instrument Development and Procurement

Back-up Behaviors Data Collection Instrument. The researcher monitored the behaviors of the team members in the field as they worked various assignments. Recordings were made on paper, identifying various assisting behaviors in order to collect future observational data. Nadler, Perkins, & Hanlon (1980) state that as observational methods become more structured, the choices available to the observer decrease, as do the opportunities for bias and error. Unlike previous back-up behavior research with Navy teams (McIntyre, et al, 1988; Peron, et al, 1989), the

researcher in this instance was able to identify 22 specific behaviors and categorize them into three classes; safety systems, digging operations, and repair/install activities. Typical back-up behaviors would be retrieving and helping with fire suits for other team members in the safety systems class, offering to take over digging in the digging operations class, and passing tools without request in the repair/install classification. These behaviors (see Appendix B for complete listing) were consistent with those activities identified by a job analysis (see Appendix C) conducted in the company prior to the onset of the present study. One of the authors of the job analysis was recruited to assist the researcher in collecting sample observations of back-up behaviors. After examination of the list of 22 potential back-up behaviors the foremen and the construction manager agreed that these behaviors were appropriate back-up behaviors which, if performed, would not jeopardize wage level demarcations by requiring team members to perform tasks for which they had not yet been approved.

The items were then listed on a single form according to class of operation (safety, digging, repair/install). Space to the right of the items was divided into three portions and team member names were placed at the top of each portion. It was designated that the numeral "1" would be placed in a team member's column next to an item when a possible back-up behavior occurred and was performed by the

team member. The numeral "2" would be inserted when a possible back-up behavior occurred and was not performed. Proportions of performed to total (performed and not performed) behaviors per item, per classification (safety, digging, repair/installation), and the aggregate total (all 21 items) would be used for data analyses. Other items on the bottom of the form were date, time of day, observer, team identification (e.g., Team "A"), and comments (see Appendix D).

Teamwork Checklist. The Teamwork Checklist (Varney, 1989) is an instrument designed to measure certain aspects of teamwork, specifically task, process, leadership, and interpersonal dimensions (see Appendix A). A few miscellaneous items also tap issues such as innovating and productivity. That instrument was selected for this study because of its length (a manageable 43 items), its language (simpler than many other team measures designed for application with groups other than at the primary level) and because it has been subjected to appropriate psychometric testing and factor analyses. These analyses indicate stable properties of internal consistency for four of the dimensions (leadership, interpersonal, task, and process). Table 1 gives the Cronbach Alpha scores for these dimensions (Varney, 1989). The checklist seeks responses to 43 items based on opposite statements (e.g., Item 1: "Communications on my team are generally guarded" and "Communications on my

team are generally open"). Respondents are instructed to mark one of five circles which best fits the situation for their particular team. These circles represent the

Table 1

Cronbach Alpha Test for Internal Consistency of Dimensions on Teamwork Checklist (Teamwork Survey, Varney, 1989)

Dimension	Alpha =
Leadership	.804 *
Interpersonal	.835 *
Process	.836 *
Task	.829 *

the following statements: "I strongly agree with the statement on the left," "I agree with the statement on the left," "I am neutral," "I agree with the statement on the right," and "I strongly agree with the statement on the right." The most positive responses that are considered to reflect better teamwork skills are assigned a value of 5; the most negative 1. Positive statements may appear on either the left or the right side of the page. The checklist was printed on white paper for Time 1 data collection; blue paper for Time 2. One additional item was added to the Time 2 Teamwork Checklist forms to be used with the six teams participating in the goal setting exercise (team-building-with-posting and team-building-without-

posting). This item asked individuals if they had reached their personal goal (to be set at workshop) of attainment of back-up behaviors. Answer options were "yes" or "no;" if "no," participants were asked to record the percentage of the goal (0 - 99%) that had been reached.

Performance Indicator. The Performance Indicator was obtained directly from the author and used to procure subjective team performance assessments from the foremen for the particular teams that they supervised (see Appendix A). Answers to items relating to quantity, quality, and timeliness consisted of responses ranging from 1 to 5 ("very little extent" to "very much extent"). The researcher added two items to the end of this instrument (a total of nine items) specific to this study which dealt with the willingness of team members to give and receive assistance from other team members. This form was printed on white paper for Time 1 data collection; blue paper for Time 2.

Procedure

Data Collection: Time 1

Observation of Back-up Behaviors. The researcher and the author of the job analysis observed teams performing the job and recorded information as explained above. Most observations at Time 1 and all observations at Time 2 were performed by one individual (the researcher). However reliability estimates performed according to Cascio (1982) on dichotomous ratings (only two possible ratings -

occurrence or non-occurrence) ranged from .71 (first observation) to .96 with an average of .90 indicating consistency of observations. An observation set was either a complete job (e.g., installation of new residential service) or a half-day performing an un-completed job, which-ever came first. Frequently, performance of a complete job required a half-day. The only female gas worker was transferred to a different department during this phase and therefore new back-up behavior observations were taken on that team after the replacement individual had received job training.

Teamwork Checklist: Foremen. The Teamwork Checklist was then administered to the foremen in order to: a) determine if the foremen thought it would be understood by the teams under study and b) determine the face validity of assignment to conditions based on the checklist results. The instructions on the cover page were read out loud to the foremen and they were instructed not to place their names on the form but to record "foremen" as a designator. Following completion of the checklist, they were questioned regarding the abilities of the team members to respond to the language of the checklist. Consensus was that most team members would have no trouble completing the checklist.

Pilot Workshop: Foremen. The appropriate analysis of the Teamwork Checklist involves recording percentages of responses per team for each item in order to determine which

teams are most lacking in the various dimensions of teamwork (personal communication, G.Varney, April 1992). I.e., if 66% or higher of the respondents on a particular team strongly agreed that "Communications on my team are guarded" and if other interpersonal dimension questions revealed similar percentages, Varney would consider that particular team a candidate for some form of team-building/team development activity. This approach was followed to analyze the information presented by the foremen and used to design a pilot workshop.

The pilot workshop's purpose was to: a) evaluate the appropriateness of assigning teams to team-building workshops based on results of the checklist and focusing team-building activities on outcomes of the survey; b) determine the usefulness of general discussion of team definition and issues; and c) practice the process of identifying and discussing back-up behaviors among the gas worker team members. The pilot workshop therefore consisted of an interactive process between the foremen and the researcher in defining a "team;" discussing teamwork characteristics and team dimensions such as interpersonal, process, task, and leadership issues; determining what constituted healthy and unhealthy teams; identifying those areas of teamwork the foremen found to be most critical (from the checklist), and confirming back-up behaviors (see Appendix B). An evaluation form was also presented to

identify weaknesses and strengths of the workshop and confirm clarity of the form. This form consisted of nine questions and responses to each item were made using a 5-point Likert type scale (i.e., 1 = strongly disagree, 3 = neutral, 5 = strongly agree).

Following completion of the workshop, analysis of the evaluation form, and consideration of verbal input from the foremen, it was determined that assignment to conditions resulting from the outcomes of the checklist was an appropriate approach. However, it was also decided that discussing the outcomes of the checklist as part of the workshop would be premature since most teams had as yet received no team-building experience. It was also acknowledged that the addition of checklist discussion to the session would take much longer than the three hours allotted. Therefore, the gas workers' team-building workshops would consist of: 1) defining a team, discussing team dimensions, determining what constitutes healthy and unhealthy teams, and identifying back-up behaviors including goal setting for attainment of same (three-hour workshop); and 2) defining a team and identifying back-up behaviors (one-hour workshop). Discussion of the Teamwork Checklist could be utilized at post-research workshops if desired by the organization (see Appendix E for workshop agenda).

Teamwork Checklist: Team Members. The checklist was administered to 32 of the gas workers in a single half-

hour session. Participants were asked to answer the questions in terms of their "normal" team configuration which was displayed by letters of the alphabet on a flip chart. They were instructed to not place their names on the checklist, but to record only the team's letter on the form. The forms were then counted and sorted by team for analysis. One form was unusable for data analysis. The last two surveys were completed one week later, when the two individuals returned from vacation. The same directions were followed.

Performance Indicator. The Performance Indicator forms were marked with the appropriate alphabetical letter for each team and completed by that team's foreman immediately following completion of the checklist by the gas worker teams. Foremen were instructed to respond to items based on each team's composite (not individual) performance.

Assignment of Teams to Conditions

Four research conditions were designed for this study (see Figure 5). These consisted of: a) team-building-with-posting strategy; b) team-building-without-posting strategy; c) posting-only strategy; and d) control (no-team-building, no-posting). All conditions had three teams, except the control condition which had four teams. However, one team leader in the control condition inadvertently took part in a back-up behavior discussion with the foremen. This team therefore participated in the research, but the data were

removed from preliminary and final analyses. The Teamwork Checklist was used to assign teams to all conditions by identifying those teams who recorded lower scores on interpersonal, process, and leadership dimensions. Team assignment was made in this fashion in order to accommodate the request of the host organization (Hakel, et al, 1985). Consequently, teams exhibiting sufficient negative responses were assigned to the three-hour session. This involved six teams. The one-hour session and control participants were randomly assigned from the pool of remaining teams. Those participants in the Team-building-with-Posting Strategy (the three-hour session) were randomly assigned to that condition from the larger sample of six Team-building teams. In order to determine equivalence among the groups, two one-way analyses of variance were performed on the back-up behaviors (Table 2) and Performance Indicator scores (Table 3) from the Time 1 data collection.

Table 2

Analysis of Variance of Back-up Behavior Scores: Total;
Time 1

Source	df	SS	MS	F-ratio
Between (B)	3	.01092	.00366	0.963
Within (W)	61	.00271	.00033	
Total	64	.00380		

Table 3

Analysis of Variance of Performance Indicator Scores: Total;
Time 1

Source	df	SS	MS	F-ratio
Between (B)	3	.00108	.00036	.078
Within (W)	27	.037	.0046	
Total	30	.03809		

Non-significant results indicated the groups were the same.

Workshops

Three-Hour Team-building Workshop. All participants were available for the team-building workshop as described above. The protocol identified at the pilot session was followed. Because discussion regarding the concept of backing-up fellow team members was an interactive process, one additional back-up behavior was identified (assist with safety belt in the safety category). This item was added to the back-up behavior form but was not used for final analyses. A goal setting activity was also added to this workshop, whereby team members were instructed to examine the back-up behaviors and set personal goals regarding attainment of those behaviors previously not performed once they returned to the job. They were encouraged to set a goal such that they would perform all possible behaviors when appropriate. Participants were then requested to

complete the workshop evaluation form and were instructed not to discuss the workshop with other teams.

One-Hour Posting Workshop. All but one participant were available for the one-hour session, which immediately followed the three-hour session. The protocol identified at the pilot session was followed with the addition of asking participants to not discuss the workshop with other teams. The missing participant discussed team definition and back-up behaviors with the researcher at a later time.

Back-up Behavior Posting

The researcher observed those teams in the posting conditions (six teams) for one complete observational set (either a half day or a completed task) two weeks after the training sessions and shared back-up behavior information with each individual. Each participant was given a posting sheet illustrating the back-up behaviors and his attainment or non-attainment as was appropriate. Team members were encouraged to refer to the posting sheet frequently as a reminder of back-up behaviors to be performed. This information on each individual was not shared with other team members, nor with the foremen and management.

Data Collection: Time 2

Observation of Back-up Behaviors. In order to maintain continuity of the researcher's activities and insulate Control teams from posting activities, their back-up behaviors were observed between the workshops and field

posting activities. Observations of all other teams then began four weeks after the training workshops. Two complete observational sets per team were recorded for analysis following identical procedures as in time 1 data collection.

Teamwork Checklist. The checklist was administered to 28 of the 34 gas workers in a single half-hour session. The cover sheets were marked with the alpha designation for each team and distributed. Those individuals who had participated in the goal setting (team-building-with and without-posting conditions) were asked to note that they had an additional page for completion. This last page asked if the team member had attained his personal goal for performing back-up behaviors and if not, what percentage of the goal was reached. Otherwise, completion of this survey was identical to the first presentation. The six people not present were asked to complete the survey at their earliest convenience. Three of six responded in a timely fashion. After several weeks, the last three surveys were deemed uncollectible. Responses were recorded for analysis.

Performance Indicator. Following completion of the checklist at time 2 by the team members, the foremen were asked to complete the Performance Indicator again for each team under their supervision. They were asked to respond to items based on each team's performance during the two months following the training workshops. These responses were recorded for analysis.

III. RESULTS

Analytic Approach

The first objective of this research was to determine the feasibility of implementing procedures designed to foster improvements in team performance which require only a limited time away from the job by utilizing a combination of strategies (team-building, goal setting for teamwork characteristics and posting of attained teamwork behaviors) designed to enhance team performance. It was thought that team-building-with-goal-setting-only and posting-only activities would not yield significant changes in teamwork characteristics or production, indicating no improvement in team performance. It was hypothesized rather, that the combination strategy would yield positive changes in team performance. To that end, data were collected on several dependent variables: a) back-up behaviors; b) team member responses to a teamwork characteristics survey; and c) supervisor responses regarding production and overall team performance. The data were analyzed in the following sequence. First, attainment of the desired teamwork characteristic of back-up behaviors was assessed. Second, changes in teamwork dimensions of leadership, productivity, process, task orientation, and interpersonal relations were assessed. Third, overall team performance was assessed. Fourth, a correlation between measures of back-up behaviors and teamwork characteristics was performed.

Objective 1: Improving Team Performance

Back-up Behaviors. The proportion of "occurred" to "could have occurred" back-up behaviors were analyzed for changes by 2 x 2 x 2 mixed model analyses of variance (within variable time 1 and time 2 by between variables team-building and no-team-building by posting and no-posting). The results of analyses performed on items in three categories (safety, digging operations, and repair/install) and total (all 22 items) are presented in Tables 4 - 7.

A main effect was found in the safety category for time (p. < .001) in addition to an interaction for posting-by-time (p < .01). Examination of Figure 6 reveals increases in the proportion of "occurred" to "could-have-occurred" safety back-up behaviors from time 1 to time 2 for all conditions. However, the most notable increases are revealed in the posting conditions (both with and without team-building) where achievement of a maximum score of 1.000 was reached by those participants at time 2, contributing to 86.2% of the variance (see Figure 7). This finding offers support for Hypothesis 1 which predicted that the team-building-with (TBP) and without-posting (TB) and posting (P) conditions would experience increases in the targeted behaviors, since 92.7% of the variance from time 1 to time 2 is derived from these three conditions.

A main effect was found in the digging category for

Table 4

Analysis of Variance of Back-up Behaviors: Safety Category

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	0.15	1.78
Posting (P)	1	0.00	0.00
TB x P	1	0.22	2.50
Team Members (M)/TB x P	40	0.09	
<u>Within Team Members</u>			
Time (T)	1	1.24	12.74 *
TB x T	1	0.00	0.01
P x T	1	0.65	6.69 **
TB x P x T	1	0.00	0.02
T x M/TB x P	40	0.10	

* $p < .001$ ** $p < .01$

Table 5

Analysis of Variance of Back-up Behaviors: Digging
Operations Category

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	0.01	0.11
Posting (P)	1	0.01	0.24
TB x P	1	0.00	0.06
Team Members (M)/TB x P	49	0.05	
<u>Within Team Members</u>			
Time (T)	1	1.32	26.56 *
TB x T	1	0.11	2.25
P x T	1	0.25	4.95 **
TB x P x T	1	0.10	1.98
T x M/TB x P	49	0.05	

* $p < .0001$

** $p < .03$

Table 6

Analysis of Variance of Back-up Behaviors: Repair/ Install Category

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	0.05	1.11
Posting (P)	1	0.14	3.46
TB x P	1	0.07	1.58
Team Members (M)/TB x P	55	0.04	
<u>Within Team Members</u>			
Time (T)	1	0.09	2.57
TB x T	1	0.01	0.34
P x T	1	0.07	2.07
TB x P x T	1	0.00	0.05
T x M/TB x P	55	0.03	

1

Table 7

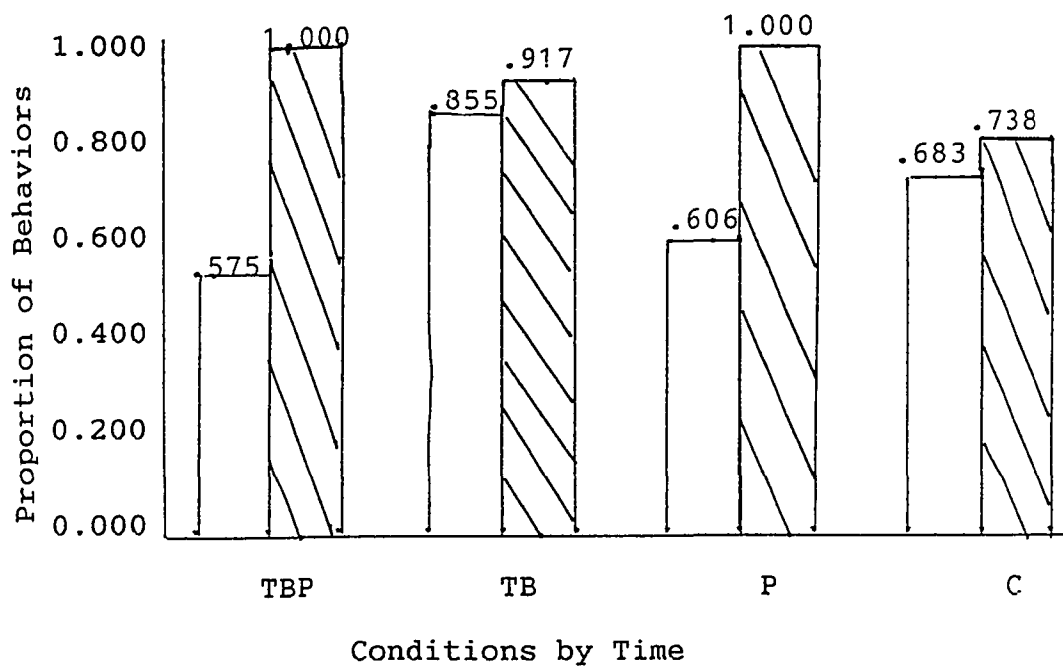
Analysis of Variance of Back-up Behaviors: Total Items

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	0.02	0.69
Posting (P)	1	0.14	5.57 *
TB x P	1	0.04	1.47
Team Members (M)/TB x P	64	0.02	
<u>Within Team Members</u>			
Time (T)	1	0.77	37.20 **
TB x T	1	0.09	4.41 ***
P x T	1	0.14	6.71 ****
TB x P x T	1	0.04	1.72
T x M/TB x P	64	0.02	

* $p < .02$ ** $p < .0001$ *** $p < .04$ **** $p < .01$

!

Figure 6: Mean Proportion of Attained Back-up Behaviors:
Safety Category



TBP Team-building-with-Posting
 TB Team-building-without-Posting
 P Posting-without-Team-building
 C Control



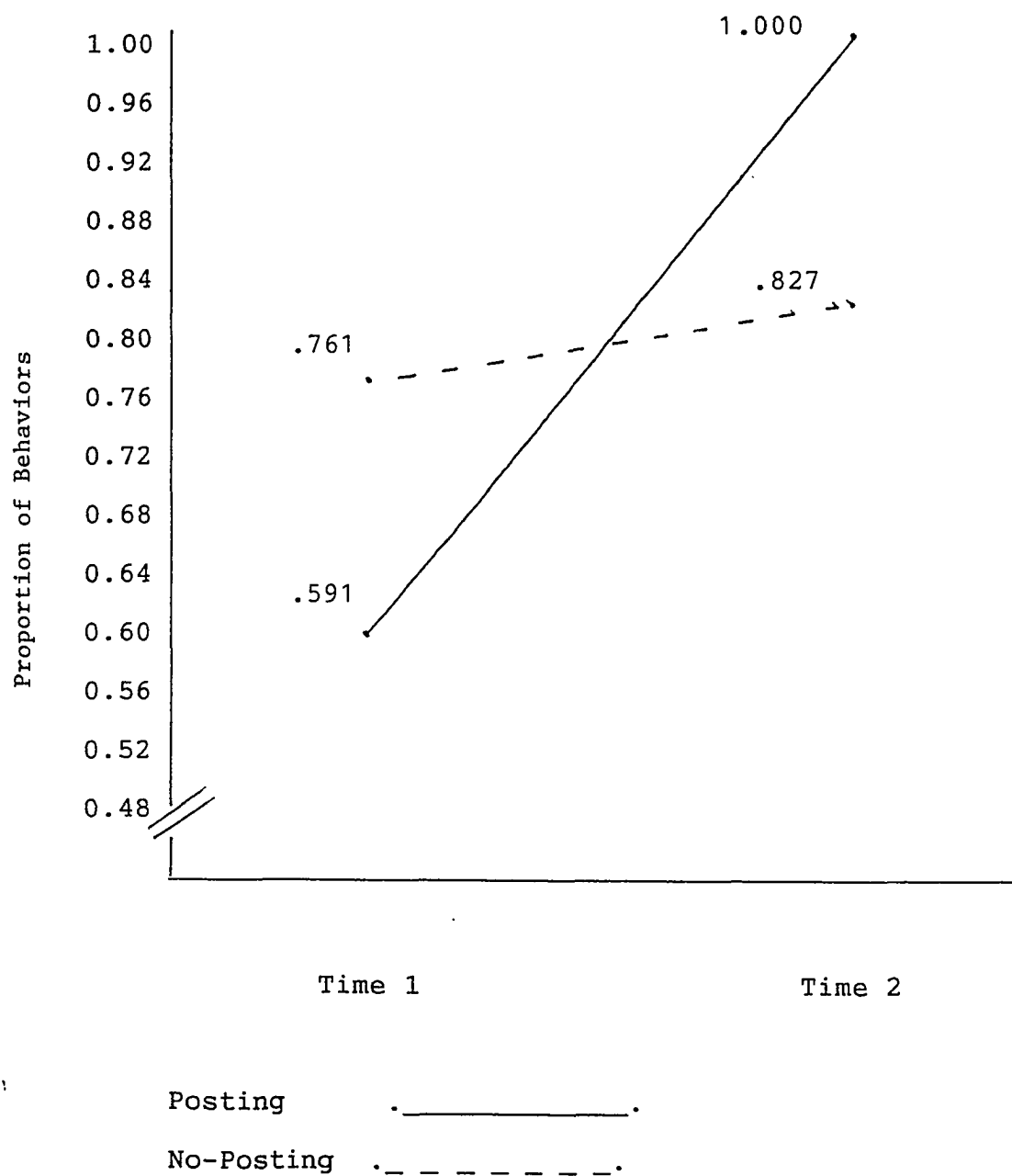
Time 1 
 Time 2 

Figure 7: Posting-By-Time Interaction for Back-up Behaviors:
Safety Category

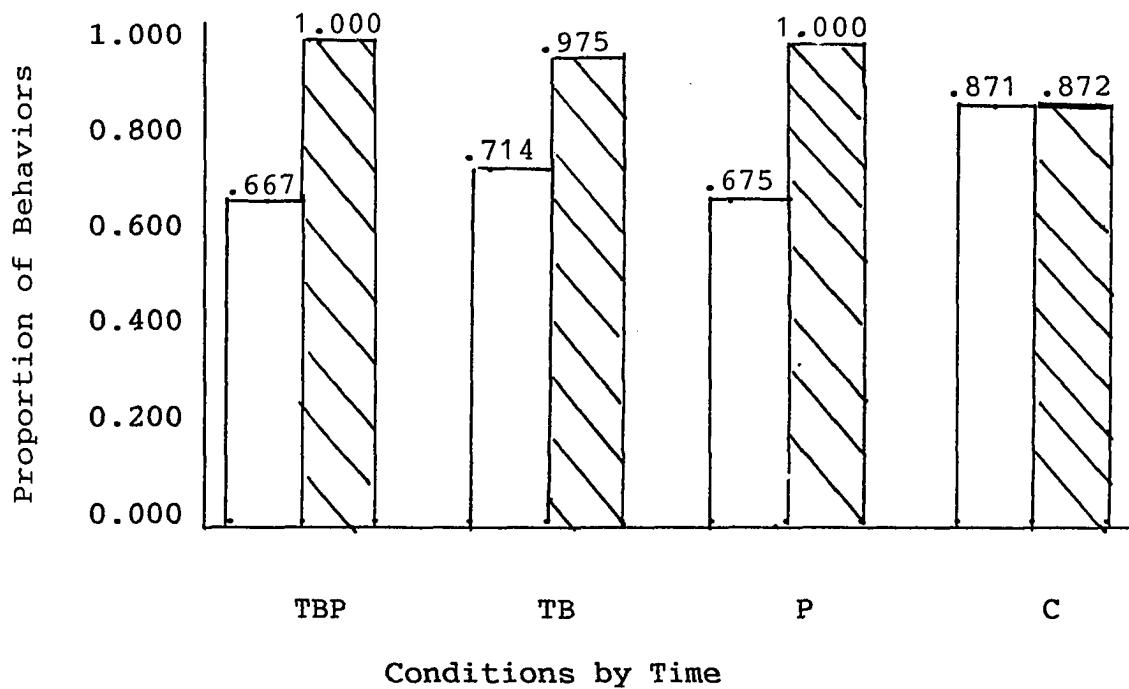


time ($p < .0001$) as well as a posting-by-time interaction ($p < .03$). Examination of Figure 8 reveals increases in the proportion of "occurred" to "could-have-occurred" digging back-up behaviors from time 1 to time 2 for all conditions. However, the most notable increases are revealed in the posting conditions (both with and without team-building) where achievement of a maximum score of 1.000 was again reached by those participants at time 2, contributing to 71.5% of the variance (see Figure 9). This finding also offers support for Hypothesis 1 since 99.9% of the variance from time 1 to time 2 is derived from the three experimental conditions.

No significant main effects or interactions were found in the repair/install category. Any changes in the proportion of "occurred" to "could-have-occurred" repair/install back-up behaviors over time were therefore insufficient to support Hypothesis 1. However, examination of Figure 10 reveals changes in the direction as predicted for all four conditions. The three experimental conditions revealed increases in proportions of behaviors (from .867 to .984 for TBP; from .886 to .920 for TB; and from .887 to .979 for P) with the control exhibiting a slight decrease in proportion (from .827 to .805) over time.

Main effects were found in the total score (all 22 back-up behavior items) for posting ($p < .02$) and time ($p < .0001$) in addition to team-building-by-time ($p < .04$) and

Figure 8: Mean Proportion of Attained Back-up Behaviors:
Digging Operations Category



TBP Team-building-with-Posting
 TB Team-building-without-Posting
 P Posting-without-Team-building
 C Control

Time 1
 Time 2

Figure 9: Posting-By-Time Interaction for Back-up Behaviors: Digging Operations Category

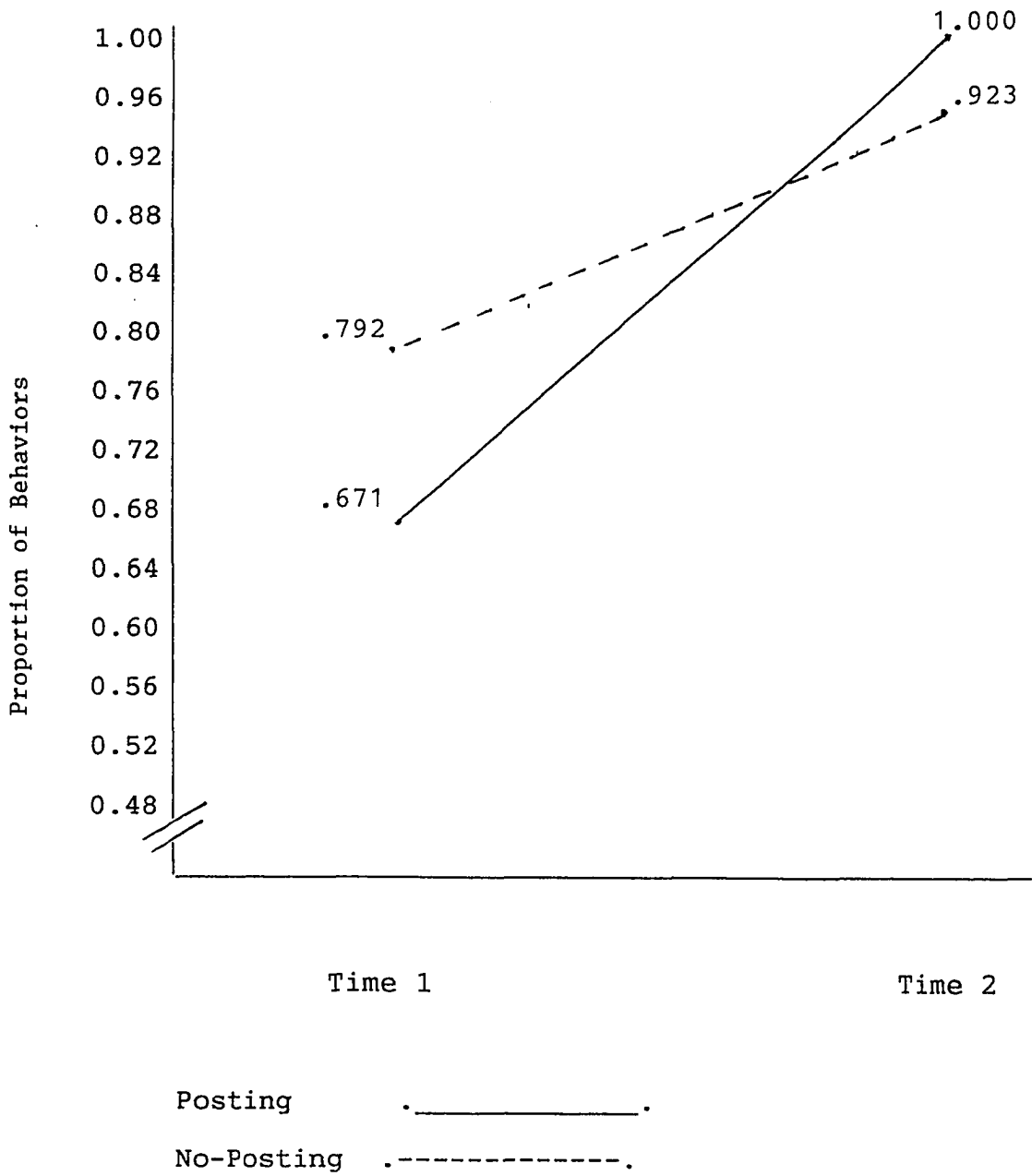
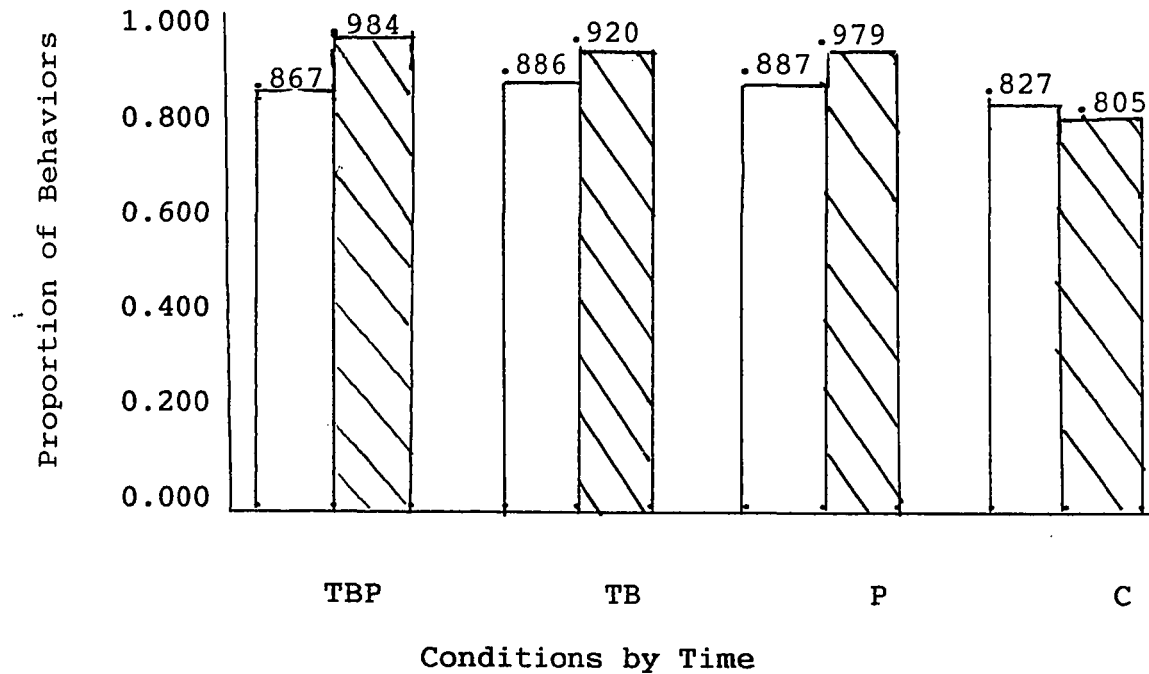
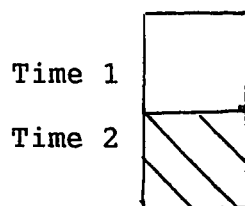


Figure 10: Mean Proportion of Attained Back-up Behaviors:
Repair/Install Category



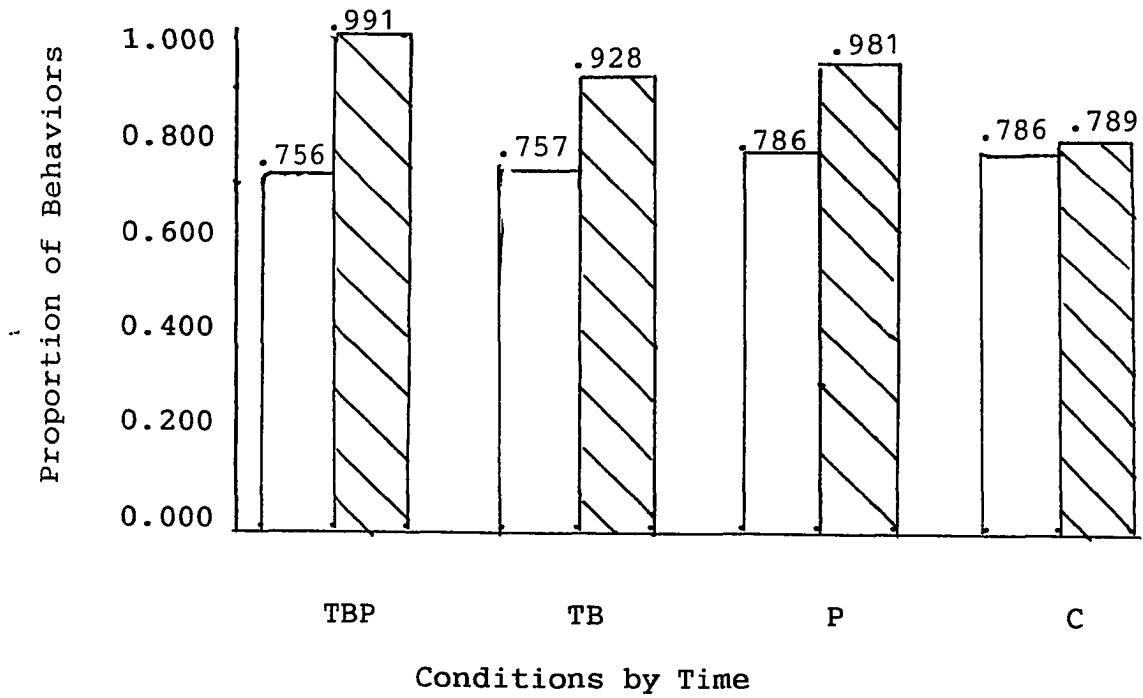
TBP Team-building-with-Posting
 TB Team-building-without-Posting
 P Posting-without-Team-building
 C Control



posting-by-time interactions ($p < .01$). Examination of Figure 11 reveals increases in the proportion of "occurred" to "could-have-occurred" total back-up behaviors from time 1 to time 2 for all experimental conditions. However, the most notable increases are again revealed in the posting conditions which contribute to 71.2% of the variance and is illustrated by the posting-by-time interaction (see Figure 12). This finding again offers support for Hypothesis 1 since 99.5% of the variance from time 1 to time 2 is derived from the three experimental conditions. Examination of Figure 13 shows the team-building-by-time interaction to be the result of higher proportion of back-up behaviors at time 1 for the two conditions without team-building (P and C) than for the team-building conditions (TBP and TB), whereas the proportion of back-up behaviors was higher at time 2 for the team-building conditions (TBP and TB) than for the conditions without team-building (P and C).

Teamwork Checklist. Team member responses to items on the Teamwork Checklist were analyzed for changes by $2 \times 2 \times 2$ mixed model analyses of variance (within variable time 1 and time 2 by between variables team-building and no team-building by posting and no-posting). The results of analyses performed on items in the five categories (leadership, process, task orientation, productivity, and interpersonal relationships) as well as total (all 43 items) are presented in Tables 8-13. A main effect for team-building is

Figure 11: Mean Proportion of Attained Back-up Behaviors:
Total Behaviors



TBP Team-building-with-Posting
 TB Team-building-without-Posting
 P Posting-without-Team-building
 C Control

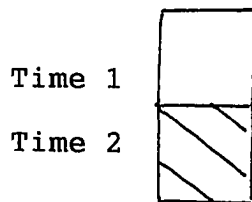


Figure 12: Posting-By-Time Interaction for Back-up Behaviors:
Total Behaviors

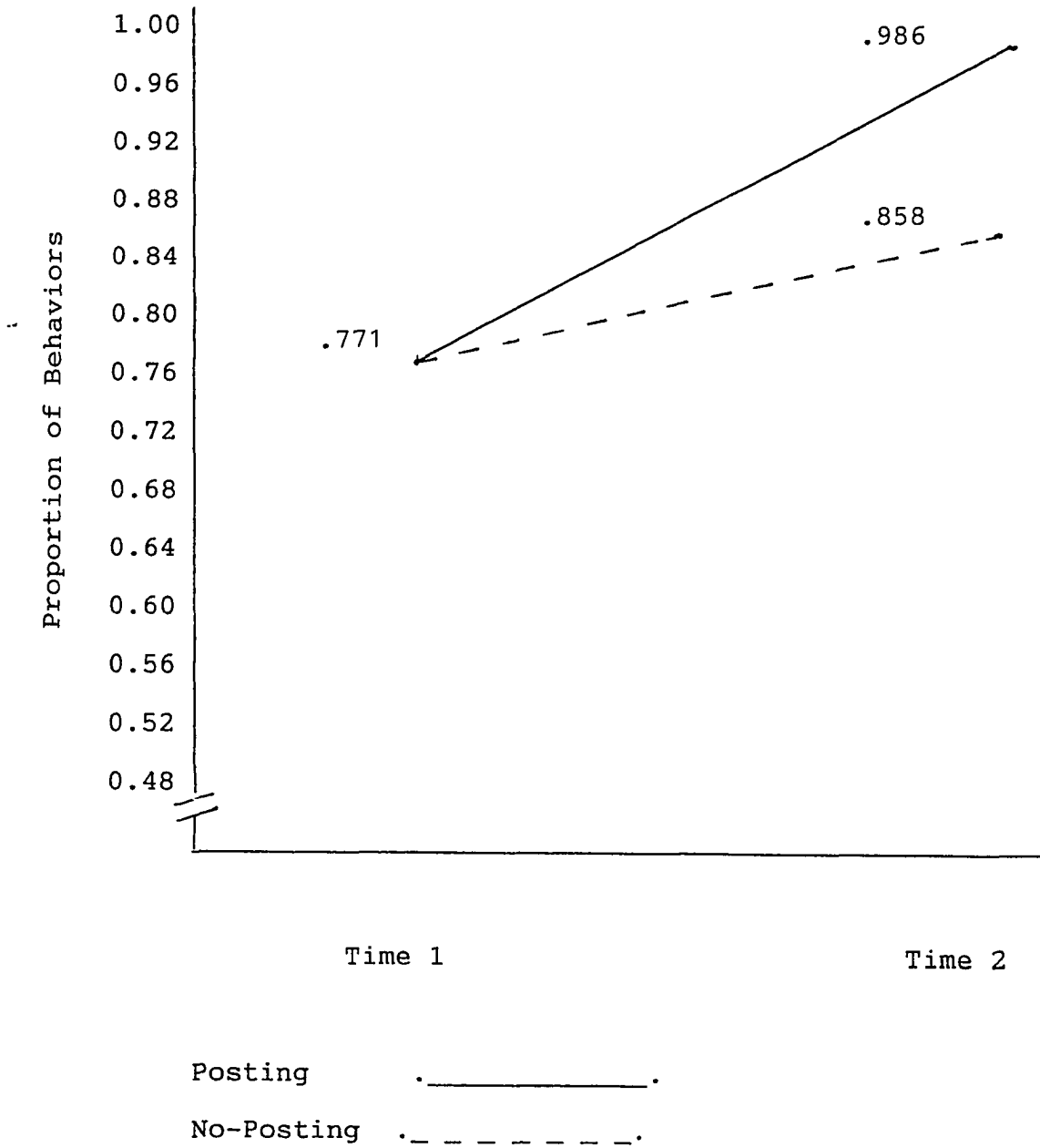


Figure 13: Team-building-By-Time Interaction for Back-up Behaviors; Total Behaviors

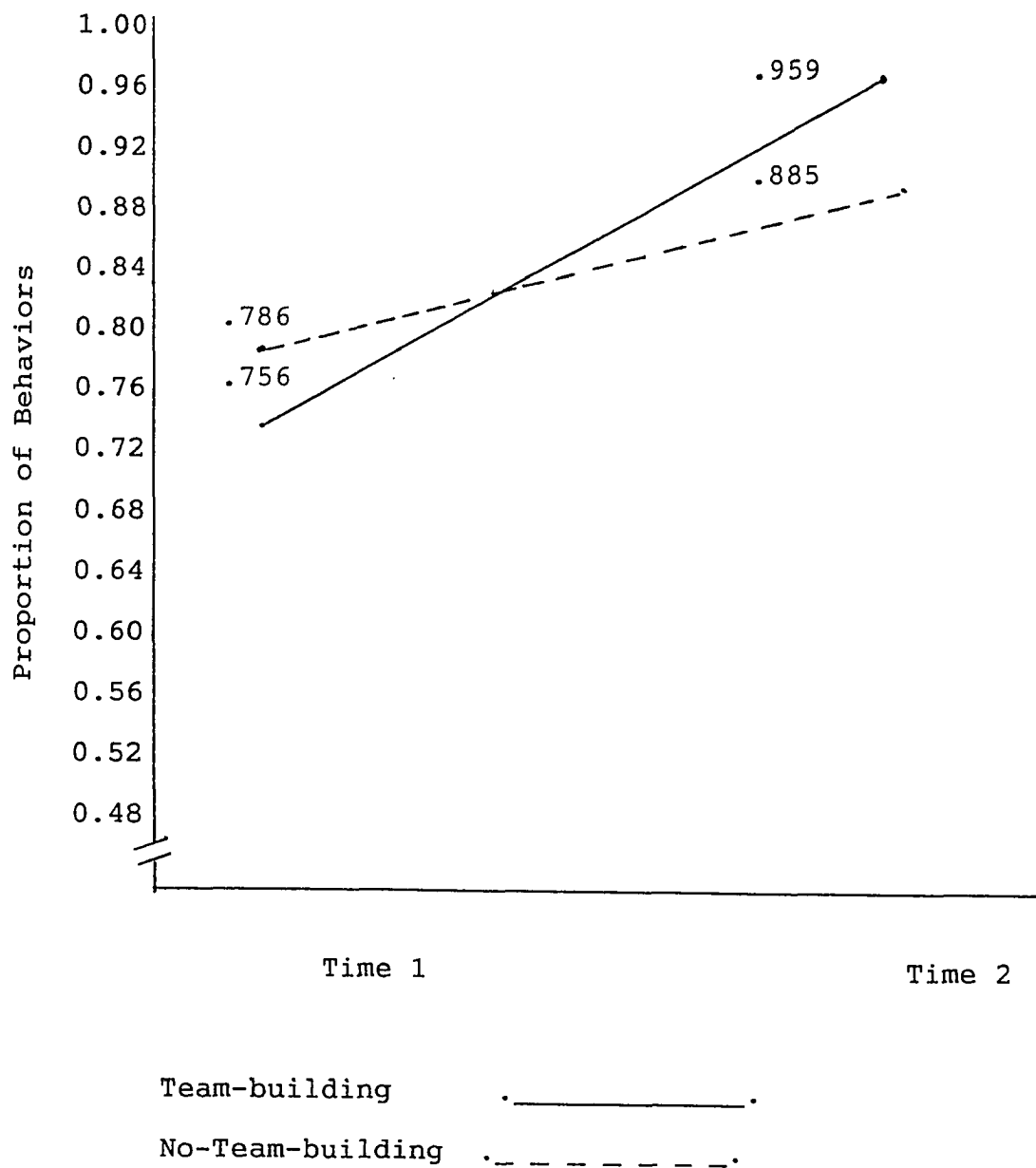


Table 8

Analysis of Variance of Teamwork Checklist: Leadership Dimension

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	6.49	7.70 *
Posting (P)	1	1.16	1.38
TB x P	1	0.30	0.36
Team Members (M)/TB x P	26	0.84	
<u>Within Team Members</u>			
Time (T)	1	0.04	0.07
TB x T	1	0.21	0.41
P x T	1	0.97	1.89
TB x P x T	1	0.15	0.28
T x M/TB x P	26	0.51	

* $p < .01$

Table 9

Analysis of Variance of Teamwork Checklist: Process Dimension

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	9.07	13.28 *
Posting (P)	1	1.94	2.84
TB x P	1	0.05	0.07
Team Members (M)/TB x P	26	0.68	
<u>Within Team Members</u>			
Time (T)	1	0.02	0.08
TB x T	1	0.66	2.07
P x T	1	0.07	0.23
TB x P x T	1	0.25	0.77
T x M/TB x P	26	0.32	

* $p < .001$

Table 10

Analysis of Variance of Teamwork Checklist: Task Dimension

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	3.33	8.60 *
Posting (P)	1	1.39	3.58
TB x P	1	0.06	0.15
Team Members (M)/TB x P	26	0.39	
<u>Within Team Members</u>			
Time (T)	1	0.04	0.14
TB x T	1	0.20	0.70
P x T	1	0.04	0.13
TB x P x T	1	0.25	0.87
T x M/TB x P	26	0.28	

* $p < .007$

Table 11

Analysis of Variance of Teamwork Checklist: Productivity Dimension

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	7.88	14.76 *
Posting (P)	1	0.99	1.86
TB x P	1	0.21	0.40
Team Members (M)/TB x P	26	0.53	
<u>Within Team Members</u>			
Time (T)	1	0.76	1.55
TB x T	1	0.02	0.05
P x T	1	0.16	0.33
TB x P x T	1	0.39	0.78
T x M/TB x P	26	0.49	

* $p < .001$

Table 12

Analysis of Variance of Teamwork Checklist: Interpersonal Relationships Dimension

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	7.78	21.37 *
Posting (P)	1	2.52	6.93 **
TB x P	1	0.05	0.15
Team Members (M)/TB x P	26	0.36	
<u>Within Team Members</u>			
Time (T)	1	0.21	0.49
TB x T	1	0.06	0.14
P x T	1	0.13	0.30
TB x P x T	1	0.05	0.12
T x M/TB x P	26	0.43	

* $p < .0001$

** $p < .01$

Table 13

Analysis of Variance of Teamwork Checklist: Total

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	6.14	14.33 *
Posting (P)	1	1.59	3.70
TB x P	1	0.01	0.02
Team Members (M)/TB x P	26	0.43	
<u>Within Team Members</u>			
Time (T)	1	0.03	0.11
TB x T	1	0.09	0.30
P x T	1	0.20	0.65
TB x P x T	1	0.16	0.53
T x M/TB x P	26	0.30	

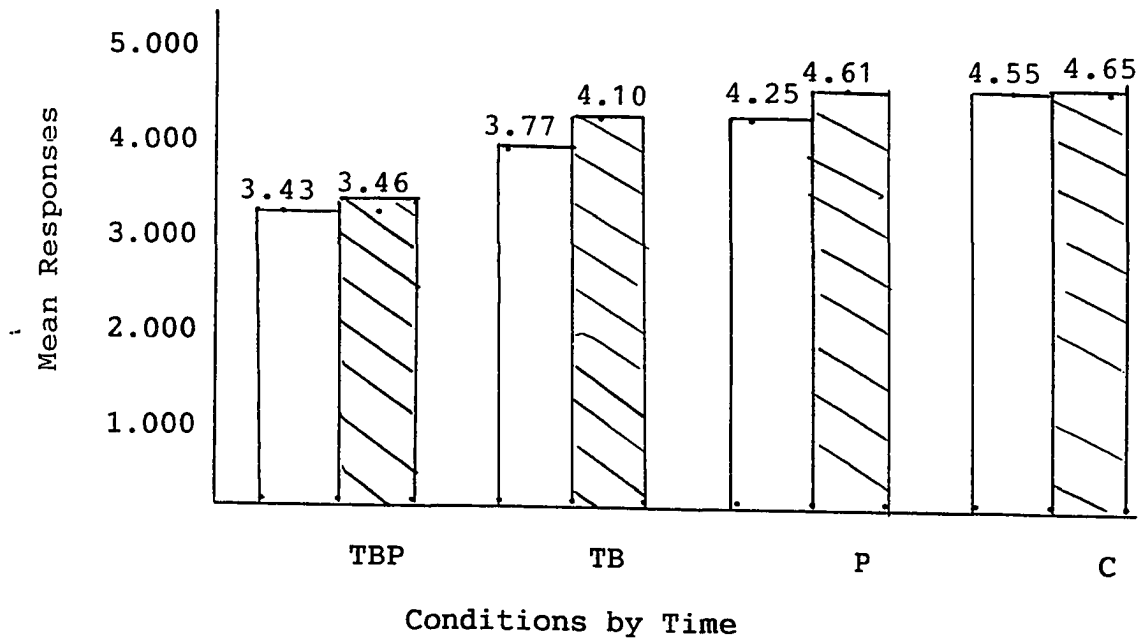
* $p < .001$

demonstrated for all categories ($p < .01$, $p < .001$, $p < .007$, $p < .001$, $p < .0001$, and $p < .001$ respectively). A main effect for posting is also revealed for interpersonal relationships ($p < .01$). In all cases above, the mean responses for the team-building and the posting conditions were lower initially and at time 2 than were the mean responses for the no-team-building and no-posting groups. There were no other main effects or interactions. The above results strongly support Hypothesis 2, which stated that team-building activities without the addition of feedback would not foster improvement in teamwork characteristics. Although results do not support Hypothesis 4 (teamwork characteristics would improve for those teams experiencing the team-building, goal setting and feedback process), examination of Figure 14 indicates changes in the interpersonal relationships dimension in the direction predicted. Results also support Hypothesis 3 since, as predicted, teamwork characteristics did not improve for those teams experiencing only the posting process. However, changes in interpersonal relationships are greater in the posting-only condition (not as predicted) and are present in the control condition (not as predicted).

Performance Indicator.

Supervisor responses to the Performance Indicator were recorded as a team score for each team member and analyzed for changes by 2 x 2 x 2 mixed model analyses of variance

Figure 14: Mean Team Member Responses to Teamwork Checklist:
Interpersonal Relationships Dimension



TBP Team-building-with-Posting
 TB Team-building-without-Posting
 P Posting-without-Team-building
 C Control

Time 1
 Time 2

(within variable time 1 and time 2 by between variables team-building and no-team-building by posting and no-posting) to reveal changes in productivity as a result of the team-building and posting training experiences. Seven of the nine items on this performance measure identified aspects relating to productivity such as quality, cost effectiveness and timeliness. These items were analyzed for a team performance score. In addition, items dealing with quality (items 2, 4, 7) were analyzed separately. A total score which included overall team performance in addition to back-up behavior items was also computed. Please refer to Table 14 for mean responses, and standard deviations by condition. Results of the analyses of variance are presented in Tables 15-17.

Main effects for team-building and time were found for the team performance score ($p < .004$ and $p < .03$ respectively) in addition to a team-building-by-posting-by-time interaction ($p < .05$). Examination of Figure 15 reveals that the posting-only condition participants had lower performance at time 1 and higher performance scores at time 2 whereas the no-posting condition participants had higher time 1 performance scores and lower time 2 scores. Please note from Table 14, that the means indicate increased performance from time 1 to time 2 for all groups except the control (which displays a decrease).

These results support Hypothesis 7 which states that

Table 14

Means and Standard Deviations of Responses to Performance Indicator

Item	TBP (n=9)	TB (n=9)	P (n=9)	C (n=7)
Quality Category (Items 2, 4, 7):				
Time 1	4.22 (0.44)	3.88 (0.16)	4.22 (0.33)	4.61 (0.44)
Time 2	4.44 (0.44)	4.44 (0.44)	4.55 (0.44)	4.14 (0.17)
Team Performance Score (Items 1-7):				
Time 1	3.85 (0.21)	3.71 (0.12)	4.04 (0.51)	4.34 (0.45)
Time 2	4.09 (0.58)	4.04 (0.43)	4.47 (0.37)	4.14 (0.27)
Total Score (all items):				
Time 1	3.88 (0.34)	3.66 (0.25)	4.07 (0.53)	4.30 (0.36)
Time 2	4.07 (0.34)	3.96 (0.25)	4.51 (0.53)	4.12 (0.36)

Table 15

Analysis of Variance of Supervisor Responses to Performance Indicator: Team Performance Score

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	1.77	9.52 *
Posting (P)	1	0.05	0.28
TB x P	1	0.03	0.14
Team Members (M)/TB x P	30	0.19	
<u>Within Team Members</u>			
Time (T)	1	0.67	4.89 **
TB x T	1	0.13	0.93
P x T	1	0.30	2.23
TB x P x T	1	0.56	4.09 ***
T x M/TB x P	30	0.14	

* $p \leq .004$

** $p \leq .03$

*** $p \leq .05$

Table 16

Analysis of Variance of Supervisor Responses to Performance Indicator: Quality Score

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	0.31	2.03
Posting (P)	1	0.13	0.85
TB x P	1	0.11	0.70
Team Members (M)/TB x P	30	0.15	
<u>Within Team Members</u>			
Time (T)	1	0.42	3.02
TB x T	1	0.89	6.35 *
P x T	1	0.24	1.70
TB x P x T	1	1.37	9.78 **
T x M/TB x P	30	0.14	

* $p \leq .01$

** $p \leq .004$

Table 17

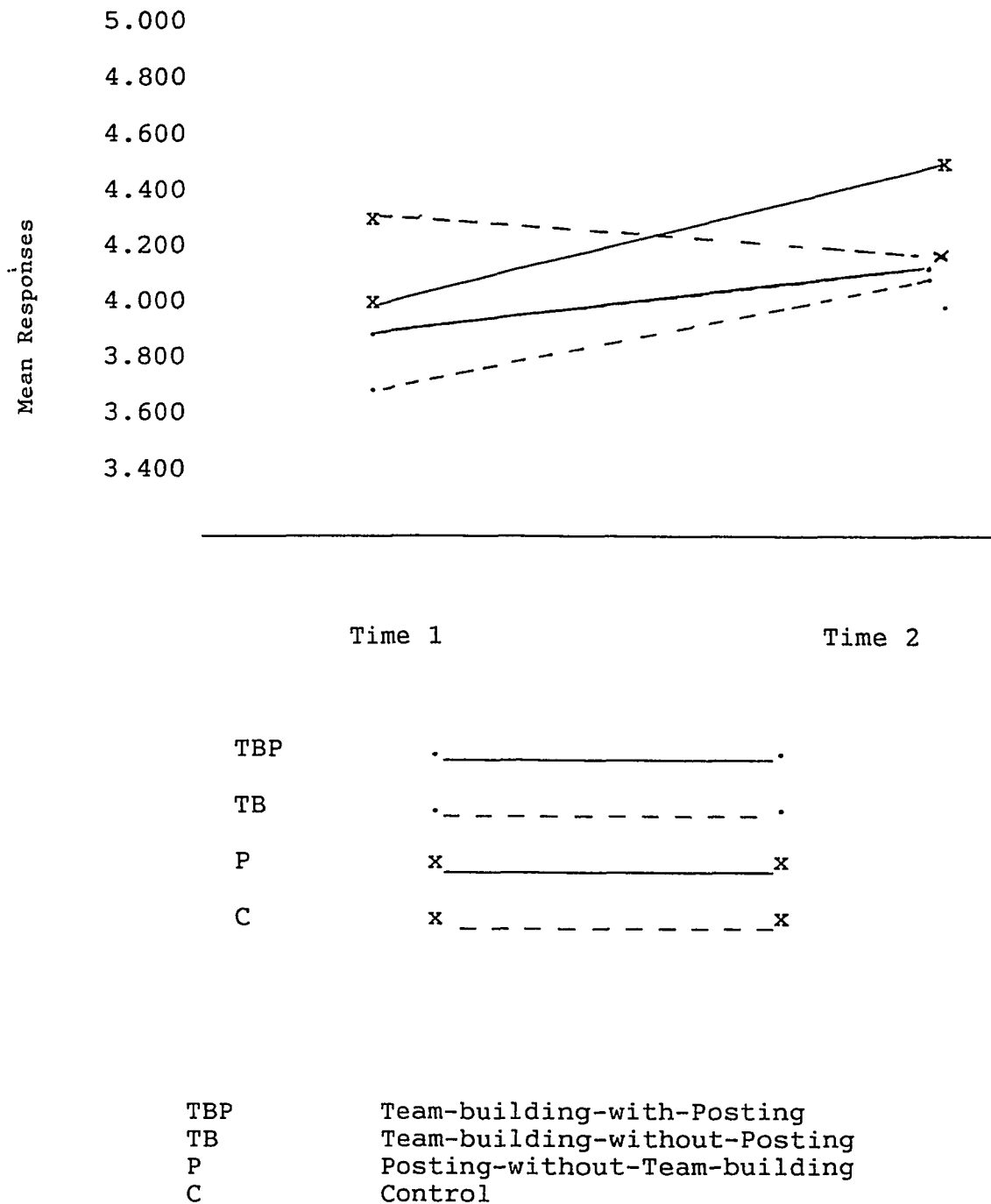
Analysis of Variance of Supervisor Responses to Performance Indicator: Total Score

Source	df	MS	F-ratio
<u>Between Team Members</u>			
Team-building (TB)	1	2.14	10.73 *
Posting (P)	1	0.26	1.30
TB x P	1	0.03	0.15
Team Members (M)/TB x P	30	0.20	
<u>Within Team Members</u>			
Time (T)	1	0.59	5.02 **
TB x T	1	0.05	0.40
P x T	1	0.27	2.29
TB x P x T	1	0.56	4.74 **
T x M/TB x P	30	0.12	

* $p \leq .003$

** $p \leq .03$

Figure 15: Interactions: Mean Supervisor Responses to Performance Indicator: Team Performance Score

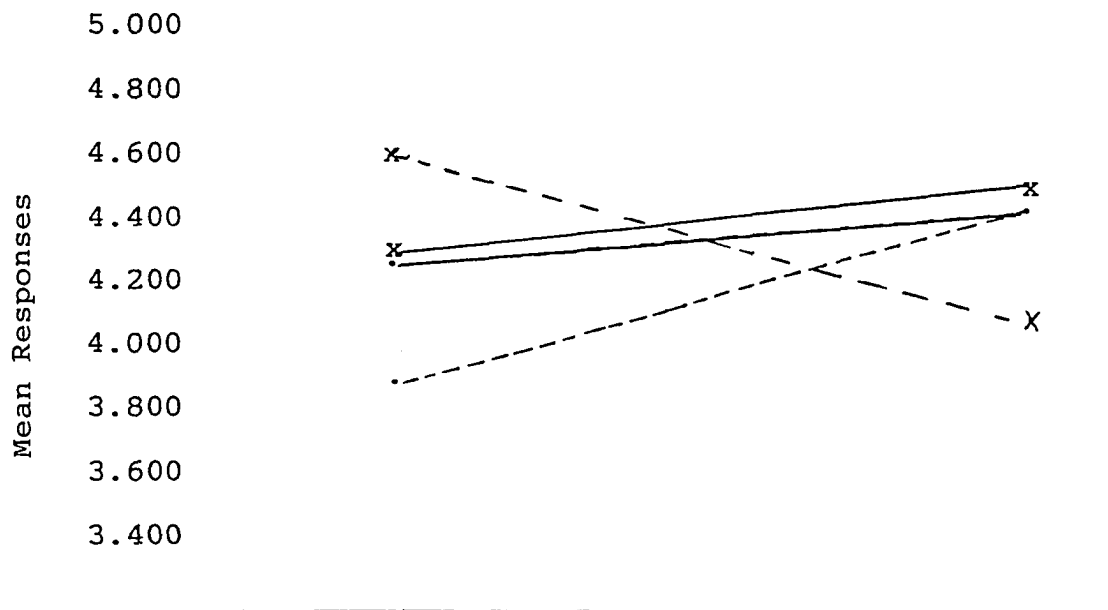


performance can be expected to improve for those teams presented with the combination team-building, goal setting and posting strategy (TBP). However, since performance improved for the team-building-only and posting-only groups, Hypotheses 5 and 6 are not supported. It should also be noted that the largest variance in performance from time 1 to time 2 was with the posting-only groups (36%).

The quality analyses (see Table 16) reveals a team-building-by-time interaction ($p < .01$) as well as a team-building-by-posting-by-time interaction ($p < .004$). Figure 16 illustrates the two-way interaction and reveals that the control teams had the highest quality scores at time 1 and the lowest quality scores at time 2, whereas all other conditions increased over time. These results again support Hypothesis 7 (the combination strategy teams would exhibit improved performance), but does not provide support for Hypotheses 5 and 6 since the posting-only and team-building-only groups display improved performance.

A total score was also analyzed (see Table 17) which included the complete Performance Indicator in addition to the two items dealing with back-up behaviors. Main effects for team-building ($p < .003$) and Time ($p < .03$) were found in addition to a team-building-by-posting-by-time interaction ($p < .03$). Figure 17 illustrates that the control groups had the highest mean responses at time 1 and were the only groups to decrease in performance over time.

Figure 16: Interactions: Mean Supervisor Responses to Performance Indicator; Quality Score



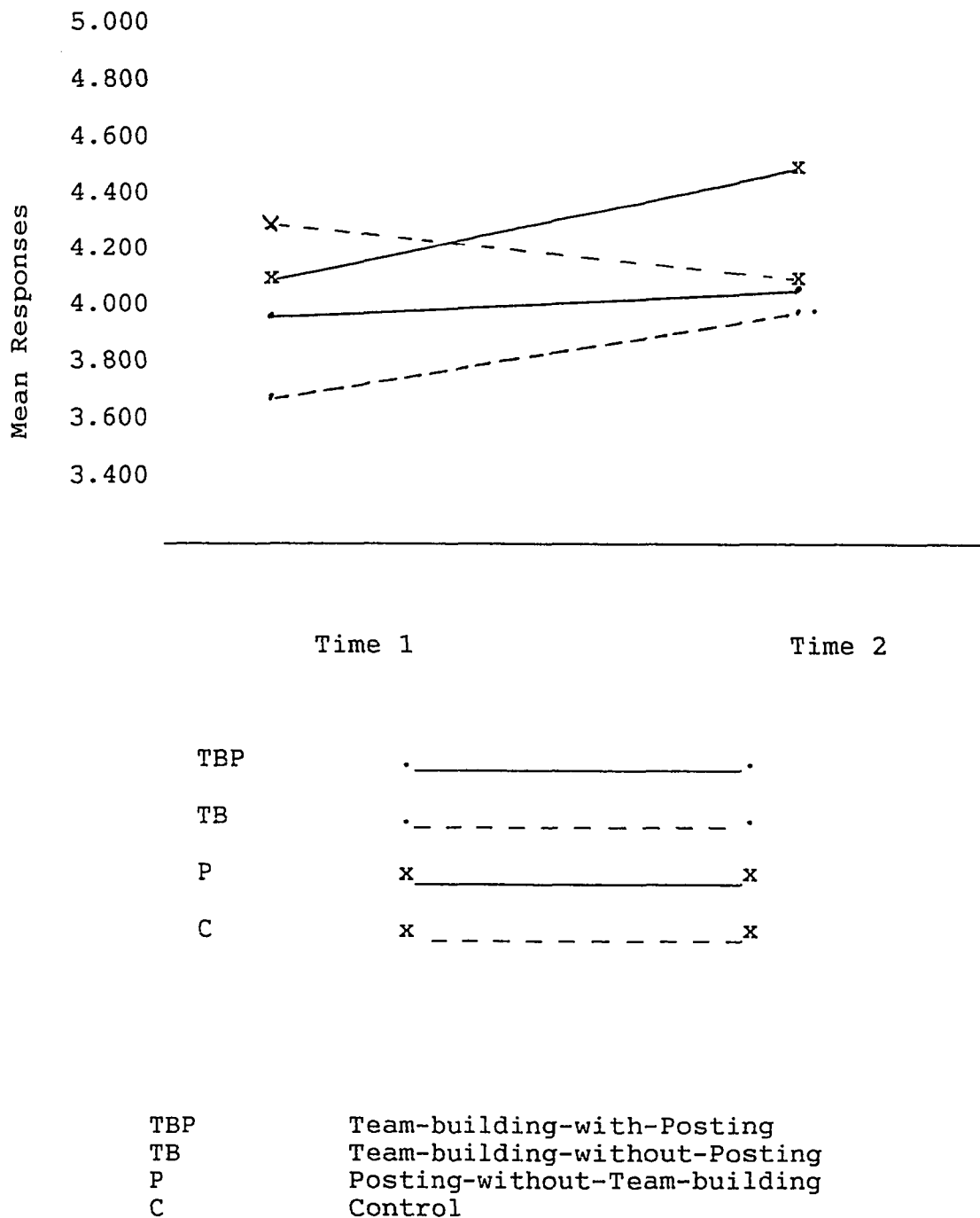
Time 1

Time 2

TBP	•	_____	•
TB	•	- - - - -	•
P	x	_____	x
C	x	- - - - -	x

TBP	Team-building-with-Posting
TB	Team-building-without-Posting
P	Posting-without-Team-building
C	Control

Figure 17: Interactions: Mean Supervisor Responses to Performance Indicator; Total Score



Support for Hypothesis 7 is again achieved, with lack of support for Hypotheses 5 and 6.

Objective 2: Training Program Development

Participant Evaluation Criteria. Participants of both the one-hour workshop (posting-only) and the three-hour workshop (team-building-with and without-posting) were asked to complete an evaluation form regarding the length, content, and appropriateness of the training experience (see Appendix E). Analyses of each item and all items scored together are presented in Tables 18 and 19. Scores were based on a 1 ("strongly disagree") to 5 ("strongly agree") scale. Results for both workshops indicate strong approval of this workshop; its content, presentation, length and transferability.

Other Results:

A correlation matrix was computed to determine correlations among the two teamwork measurement instruments used for this study (the Teamwork Checklist, n= 34; and the back-up behavior scores, n= 68). This matrix is presented in Table 20 and indicates a strong correlation between Teamwork Checklist responses and back-up behaviors at both time 1 and time 2. This result provides strength for the concept that back-up behaviors are a teamwork characteristic, since the correlation increases from .675 ($p < .01$) to .791 ($p < .01$) over time.

Table 18

Participant Evaluation: Three-Hour Workshop

Item	Mean	S.D
Teamwork discussion dealt with most team issues	4.833	0.514
Team definition was a worthwhile process	4.833	0.383
Trainer was knowledgeable about team issues	5.000	0.000
Trainer was knowledgeable about my job issues	4.777	0.427
Trainer had annoying habits I found distracting (reversed for scoring)	4.944	0.235
It was difficult to identify back-up behaviors (reversed for scoring)	4.777	0.548
This workshop was worthwhile	4.777	0.548
This workshop should have been longer (reversed for scoring)	4.555	0.615
I will take new information/skills back to my job	4.722	0.574

 n = 18

:

Table 19

Participant Evaluation: One-Hour Workshop

Item	Mean	S.D
Team definition was a worthwhile process	4.888	0.333
Trainer was knowledgeable about team issues	5.000	0.000
Trainer was knowledgeable about my job issues	4.888	0.333
Trainer had annoying habits I found distracting (reversed for scoring)	4.888	0.333
It was difficult to identify back-up behaviors (reversed for scoring)	4.777	0.441
This workshop was worthwhile	5.000	0.000
This workshop should have been longer (reversed for scoring)	4.555	0.726
I will take new information/skills back to my job	5.000	0.000

n = 9

1

Table 20

Correlation Matrix: Teamwork Checklist, Back-up Behaviors

	Time 1		Time 2	
	TC	BB	TC	BB
Time 1				
TC	_____	.675 **	.408 *	.436 *
BB		_____	.109	.858 **
Time 2				
TC			_____	.791 **
BB				_____

* $p < .05$ ** $p < .01$ TC Teamwork Checklist

BB Back-up Behaviors

:

IV. DISCUSSION

Until now, relatively little research effort has been devoted to enhancing the performance of teams at the organization's primary level of production (the first organizational level which has an identifiable product as its outcome). Due to time and financial constraints, short-term production losses, and lack of participant interest in "typical" team-building activities, management characteristically has been less than enthusiastic about involving these work groups in "extra" team development activities. The present study was conducted to: a) determine if procedures designed to foster improvements in team performance requiring only a short time away from the task at hand would enhance overall team performance, as well as various teamwork characteristics; b) formulate recommendations for team training programs in this context; and c) contribute data useful for multi-site reliability and predictive validity studies of teamwork measurement instruments. Findings and relevant conclusions are discussed in detail below as they relate to the seven hypotheses proposed to examine the first goal of this endeavor (a). A training protocol, based on clues offered by this research is presented in Appendix F (b). Finally, appropriate data collected from the two teamwork measurement instruments have been forwarded to G. Varney's staff for inclusion in on-going multi-site teamwork studies (c).

Summary of Research Conditions

Before discussing hypothesis support, however, it would be appropriate to review the content of the intervention workshops since the content defines the conditions of research. The team-building-with-posting (TBP) condition consisted of a single three-hour workshop. Workshop discussion concentrated on defining a team, identifying teamwork characteristics while concentrating on specific back-up behaviors, determining what constituted healthy and unhealthy work groups, identifying the overall team goal, and setting personal goals for attainment of back-up behaviors on the job. In addition, this group, when observed in the field following the workshop session, received individual feedback in a posted format regarding their actual employment of back-up behaviors at work. The team-building-only condition (TB) consisted of all the workshop activities described above; but participants received no feedback (that is, no posting) regarding frequency of back-up behaviors. The posting-only condition (P) consisted of a one-hour discussion of team definition and identification of back-up behaviors. These teams were then observed in the field following the workshop session and received individual feedback in a posted format regarding attainment of the desired behaviors. The control condition (C) participants did not take part in either workshop, nor did they receive feedback regarding the

targeted behaviors on the job. Three teams participated in each of these conditions.

Hypothesis Support

Objective 1: Improving Team Performance

The first and foremost goal of this research was to improve team performance by implementing interventions that focused on the teamwork aspects of group activities and would then result in improved production.

Improving Teamwork: Most recent team research (e.g., McIntyre, et al, 1991) has incorporated the concept that utilization of such teamwork skills as backing-up behaviors among team members is characteristic of high performing teams (e.g., Peron, et al, 1989). Consequently, this research focused on means of introducing (via short-term team-building workshops) this concept to groups of people in an actual work setting, identifying the appropriate back-up behaviors for the particular situation, and fostering their use of such behaviors by either posting of feedback information (e.g., Anderson, et al, 1988; Peron, et al, 1989) and/or goal setting (e.g., Locke, et al, 1981; Locke & Latham, 1990a). It was thought that other team-building activities (e.g., Hughes, et al, 1983; Huse & Cummings, 1985; Larson & LaFasto, 1989), such as discussing a clear goal, confirming what constituted a "team" and healthy work group would provide additional support for other teamwork characteristics and dimensions (such as leadership, team

processes, and interpersonal relationships) and thereby improve overall team performance outcomes (Varney, 1989; Hackman, 1990). There were significant main effects shown for team-building for all of the above dimensions; as was to be expected since the host management requested that teams be assigned to experimental conditions based on their responses to the teamwork checklist. As mentioned before, the researcher needs to diagnose and accommodate to the needs of the organization when performing research and designing training strategies for implementation (Goldstein & Associates, 1989; Robinson & Robinson, 1989; Muchinsky, 1990). Consequently, the six teams with lowest scores on the interpersonal relationships, team processes, and leadership dimensions were assigned to the team-building conditions (TBP and TB). Introduction of only back-up behaviors and subsequent posting indices of attainment of those behaviors (one-hour workshop) was undertaken in an attempt to isolate the effect that the posting of back-up behaviors may have had on the process.

Results of the correlations performed on the two dependent teamwork measures for this study (back-up behaviors and Teamwork Checklist) provide strong support for a correlation between back-up behaviors and teamwork characteristics in general (see Table 20). More importantly, as back-up behaviors increased from time 1 to time 2, the correlation became stronger. Since back-up

behaviors are task-related, this result provides clues for further work applications and research examining the elusive taskwork-teamwork relationship.

Hypothesis 1: Back-up behaviors increase for those teams experiencing the team-building, team-building-with-posting and posting-only interventions. Teamwork applications that are salient and job-related and are presented in a conference-type atmosphere of short duration can be transferred more easily to the job at hand, especially when feedback is involved.

Identification and fostering of those back-up behaviors appropriate for this situation were the integral ingredients in all experimental conditions and were consequently measured separately. Results of this research strongly support this hypothesis.

Since behaviors are presented to the team members in an organizing framework (Wexley & Latham, 1981) related to their tasks (safety activities, digging operations, and repair and installation), the data have been analyzed following that same framework. Significant increases in behaviors found from time 1 to time 2 for the safety-related activities, the digging operations, and for the total (all behaviors) indicate increased behaviors over time for all groups except the control. (Although the control groups experienced an increase in behaviors for the safety and digging categories, they provide less than 8% and .01% of

the variance, respectively). The results of the repair/install analyses were not significant, however, all means increased over time except for the control groups. More importantly, the most notable increases occur for the posting conditions where increases are large and nearly the same for both the team-building-with-posting (TBP) and the posting-only (P) teams.

The above results are expected for a number of reasons. First, it is proposed that team members find back-up behavior activities to be salient and practical, and are therefore willing to perform those behaviors (Bandura, 1987). Secondly, it is proposed that since the back-up behaviors are meaningful and job-related, transference of learning from the workshop to the job would not be difficult and team members would immediately be able to apply this new knowledge to the task (Wexley & Latham, 1981). Thirdly, it is acknowledged that team members in all conditions except the control, have a clear notion of what behaviors the observer expects to see once they have attended either workshop. Fourthly, feedback in the form of written and specific information is expected to act as reinforcement. Finally, goal-setting is expected to enhance the acquisition and repetition of targeted behaviors.

These findings also suggest that the feedback strategy may have had greater impact than the team-building-with-goal-setting strategy, although which strategy fostered

increases in desired safety behaviors as well. This finding is consistent with those of Anderson, et al (1988), and Peron, et al (1989) regarding the posting of desired behaviors and Wexley & Latham (1981) regarding feedback in general.

A few important differences between current and past research should be noted here. Anderson, et al (1988), working with a university hockey team saw increases in desired behaviors after the researchers publicly posted (on locker room door) the occurrences of those behaviors (body-checking) by team members. Peron, et al (1989) saw an increase in occurrences of back-up behaviors when Navy instructors posted proportions of missed to total possible occurrences for each team member in an obvious place (on training room door). In both of these examples, no explanation was given to team members regarding what was expected and the organizational atmosphere was different than at the present company. Student athletic teams and Navy training teams are more submissive to the impulses of their coaches, instructors, and officers than are real work teams to the activities of their supervisors. Strategies that can be implemented without explanation in the military may not be so easily accepted by incumbents in the private sector, especially where unions monitor and question activities directed toward union members. The conclusion can be drawn that competition among individuals may have

contributed to the increases in observed back-up behaviors for both the Navy teams (Peron, et al, 1989) and the hockey teams (Anderson, et al, 1988). That explanation cannot be applied in this situation, since feedback regarding attainment of specific back-up behaviors was done individually. Rasmussen (1982) states that better learning occurs when groups are trained individually toward mastery of a set of skills rather than competitively. We can speculate from these results that individual and private feedback (Prue & Fairbank, 1981), in this case utilizing the posting format (the team members retained a copy of the information) was as successful as any competition-inducing strategy (including public posting) may have been. This concurs with anecdotal information regarding a previous unsuccessfully implemented competition among these teams to increase productivity.

The team-building-with-posting (TBP) conditions showed the most improvement in attainment of digging operations and total back-up behaviors as displayed in Figures 8 and 11. An integral part of the team-building activity was a goal setting strategy whereby team members were instructed to set high personal goals regarding the attainment of back-up behaviors. Post-intervention queries regarding attainment of those goals by each individual revealed that 17 of 18 team members felt they had achieved their personal goals. This is reflected in the proportions of total attained

behaviors for the goal setting conditions (TBP = .991, TB = .928). Although the team-building-only condition exhibited increases in mean proportions of back-up behaviors, the increases were not as large as for the combination strategy and the posting-only strategy ($P = .981$). This is in agreement with Balcazar, et al (1986) in that strongest results are produced when goal setting and some form of feedback are combined.

A question can be raised regarding the similarity in effect between goal setting and posting of feedback, however. Balcazar, et al (1986) have identified one problem with research on feedback, namely that the literature has not frequently differentiated feedback when it is applied alone and when it is used in combination with other procedures such as goal setting. This particular research attempted to make that distinction. However, it is possible that the posted feedback information served as an unstated but conscious goal setting strategy, driving team members to higher levels of performance (Steers, 1985). For example, Locke, et al (1981) state that goals influence task performance by focusing attention and action as well as enhancing energy and Siegel & Lane (1987) and Huse & Cummings (1985) indicate that clearly stated and specific goals will improve effort leading to better performance. The fact that the back-up behaviors were specific, clearly stated and obviously salient to team members provides

further support for these statements if they were used as goals by the team members.

Hypothesis 2: Hypothesis 2 states that there will be no perceived improvement (by team members) in teamwork characteristics (other than back-up behaviors) for teams presented with only the team-building intervention. It is postulated that increased awareness of interpersonal relationships, leadership, and better communication require a two to three day setting in order to foster stronger affective attitudes toward continuing as a group member and improving general feelings toward interpersonal, leadership, and team process issues.

These characteristics (e.g., Nieva, et al, 1978; Bass, 1982; Freeberg & Rock, 1987; and Hackman, 1990) of leadership, interpersonal relationships, team processes, and task are also referred to as teamwork dimensions (e.g., Varney, 1989). Results strongly support this hypothesis since the team-building-only teams did not significantly improve on any of the teamwork characteristic dimensions.

Hypothesis 3: Perceived improvement (by team members) in teamwork characteristics (other than back-up behaviors) does not occur for those teams presented with the posting only intervention. Results support this hypothesis since, as predicted, teamwork characteristics did not improve for those teams experiencing only the posting process. However, changes over time in team member responses to items in the

interpersonal relationships category are greater in the posting-only condition (not as predicted) and are present in the control condition (also not as predicted). As stated above, establishing the link between improvement in teamwork characteristics and improved performance requires more than introduction of the concept of back-up behaviors even with attendant feedback on attainment of same.

Hypothesis 4: Hypothesis 4 states that perceived improvement (by team members) in teamwork characteristics (other than back-up behaviors) does occur for those teams presented with the combination of team-building, goal setting, and posting interventions. Knowledge of clearly stated goals and presumed commitment to them yields positive results regardless of whether the goals are imposed or participatively generated. The goals create a benchmark to be striven for by participants. Goal setting strategies can be utilized for teamwork behaviors as well as task behavior acquisition.

Although results do not support this hypothesis, examination of Figure 14 indicates that for at least one teamwork dimension (other than back-up behaviors) changes did occur in the direction postulated. It must be noted that increases in responses also occurred for all conditions, including the control. The two team-building conditions involved participation in discussion during the workshops which addressed some interpersonal issues (e.g.,

communication, loyalty) and may have resulted in fostering improvements in that area. However, the posting condition participants also showed improvements for interpersonal issues (see Hypothesis 3 discussion, previous page). All three of these groups participated in the back-up behavior identification and discussion. We can postulate that performance of back-up behaviors may have served to reduce tension among team members. Perhaps the seeds for an attitude of mutual and symbiotic support among team members was fostered by the identification of, and authorization by management to perform, back-up behaviors. Anecdotal comments from team members in the posting condition indicated that everyone seemed to be working together more smoothly and with less antagonism since the workshops.

Control condition participants showed improvements for this dimension as well. All groups may have been on their "good behavior" during this particular study (Blake & Mouton, 1981), and may have been pleased that a research endeavor was directed at their particular work domain. Even though additional evidence has shown that what is commonly referred to as "Hawthorne effect" (Roethlisberger, 1939) is really something else related to teamwork rather than the consultant/management attention it commonly refers to, academic and nonacademic literature still refer to the Hawthorne effect for explanation of increases in measures for groups in control conditions (e.g. Raynor, 1993;

Hughes, et al, 1983). This is consistent with Hughes, et al (1983) team development activities with U.S. Air Force Academy squadrons whereby both control and experimental condition participants displayed improved performance over time. In this case and that, control participants completed surveys before and after the workshop interventions and were also observed in the field. A likely assumption on the part of these participants was that the researcher was interested in their opinions and jobs and they reacted with increased affect toward other team members.

Although Hughes, et al (1983) did not account for possible team maturation effects (e.g., Gersick, 1983, and Glickman, et al, 1985), maturation would have been a likely contribution to his positive findings over time. In the present research, even though these were stable teams, maturation may have contributed to overall performance. It is acknowledged that teamwork is dynamic (e.g., McIntyre, et al 1991; Kinlaw, 1991; Blake, et al, 1987), and it has not yet been determined when a stable work team (as opposed to a special project or task force team) becomes sufficiently "mature" to cease maturing (or the maturation curve becomes asymptotic). It would therefore, be realistic to expect mature teams to continue to show signs of learning or maturation, however small that improvement might be, whenever the work task, situation or setting undergoes some appreciable modification (as might be represented by this

researcher's intervention).

Also, it has been noted that due to vacation and weekend coverage, team configuration was sometimes temporarily altered during this study. It is more than likely that some control participants were the recipients of altered attitudes concerning, at the very least, the willingness to perform back-up behaviors. Since these groups also scored higher on teamwork dimensions initially, their members may have been more responsive to overtures by members of other teams. In addition, since these members scored higher on interpersonal and process dimensions, they may have continued to use appropriate team processes and continued to improve interpersonal relationships during the course of this study (Varney, 1989).

There is also always the possibility that outside influences or events contributed to how team members viewed their teams on the particular days the checklists were administered. A particularly difficult task or long working hours could have altered member perceptions toward each other. Any event having an opposite effect could have affected control participants' perceptions as well.

Improving Productivity: Hackman (1983, 1990) has defined production outcomes as quality, quantity, and timeliness and states that although it is not necessary to always measure outcomes, they must be potentially assessable. In this particular setting, objective

production data (e.g., number of feet of installation, number of leaks found, quality of joint work, etc.) is not routinely collected for each team. Many contingencies impact the process of task completion. For instance, installation, retirement of equipment, and service of leaks may be beyond the control of the team members (e.g., installation of service in a rocky and wooded neighborhood requires a different approach and more time than installation in a sandy-soiled and tree-less neighborhood). In addition, although objective production data are valuable to the researcher, establishment of an accurate objective measure would be costly to implement and maintain for the organization. Cost effectiveness was one of the results criteria (Kirkpatrick, 1976) important to this particular company. An alternative measure of production would be subjective ratings from supervisors.

Consequently, we looked to the foremen, who routinely (several times per day) spot-check each team's progress and processes and therefore have reasonable knowledge regarding the nature of each team's outcomes, to determine team performance. Productivity therefore, was measured subjectively by supervisor responses to the Performance Indicator (Varney, 1990) on team production outcomes of quantity, quality, and timeliness (Hackman, 1990), and overall team performance. This instrument has seven items addressing the above mentioned elements. Two other items

were added for the purpose of this research which related to the willingness on the part of team members to give and receive assistance (back-up behaviors). The indicator was therefore analyzed by related items (quality, and back-up behaviors), by the total of all items excluding back-up behaviors (team performance score), and by the total of all items including back-up behaviors (total score).

Hypothesis 5: Hypothesis 5 states that productivity as defined by quantity, quality, timeliness, and overall team performance does not increase for teams presented with only the team-building training. It was reasoned that production outcomes should improve with the enhancement of processes required for teamwork, namely communication and back-up behaviors when team-building workshops consume two-to-three days, but that these teamwork enhancements cannot be absorbed effectively in a short period of time without the aid of other reinforcers.

This hypothesis is not supported since the team performance score, quality score and total score showed improvement over time for the team-building-only groups. The three-hour team-building workshop helped to establish that the overall team goal was unequivocally one of safety. Larson & La Fasto (1989) state that reduced performance in teams is frequently the result of goal anomaly or the lack of clear and stated goals, and Bucholz, et al (1987) indicate that as a group of individuals becomes a "team," it

uses the common purpose to focus energy (see Figure 1). Here, in the process of defining safety, general opinion was that by following proper procedure and doing things right the first time, each team could achieve accident-free task completion. In other words, the shared common purpose was definitely safety as achieved by following proper procedures. "Doing it right the first time" is also the hue and cry of Total Quality Management and other quality conscious programs, advertisements, etc. It is possible that these outside influences coupled with the safety goal discussion served to foster greater commitment to quality for those individuals involved in the three-hour team-building workshops.

Hypothesis 6: Hypothesis 6 states that productivity does not increase for those teams presented with the posting only intervention. Even though the posting strategy provides feedback for specific and appropriate targeted behaviors, feedback and discussion of back-up behaviors alone are insufficient to produce changes in overall performance.

This hypothesis is also not supported by the current study, since performance did improve for the posting-only groups on the quality, team performance and total scores. Examination of mean foremen responses on Table 14 reveals that the posting-only groups showed the largest increases over time in the quality and total measures and second

largest in the team performance measure. It is interesting that these groups display such improvement even though they participated in the shortest workshop. Again, a clue is provided for future training in that the shorter presentation (Wexley & Latham, 1981) coupled with feedback (e.g., Muchinsky, 1990; Anderson, et al, 1988) may foster better acquisition of teamwork skills and hence improved performance. The type of feedback (posted information for specific back-up behaviors) used in the present study may be analogous to goal setting strategies (e.g., Locke, 1968; Locke, et al, 1981; Locke & Latham, 1990b) if as mentioned before, knowledge of feedback in this situation fostered implicit goal setting. Attention to the posted information may have induced the intention to perform targeted behaviors and subsequently the actual performance of same (e.g., Fishbein & Ajzen, 1975; Steers, 1985; Zimmer, 1990), subsequently leading to improved performance.

Hypothesis 7: Hypothesis 7 states that productivity does increase for those teams presented with the combination of team-building, goal setting, and posting interventions. Combining the three strategies provides team members with the necessary teamwork tools to perform as a team more efficiently, as well as offering goals for teamwork enhancing skills by cuing and reinforcing those skill behaviors; hence improving performance.

The results of the study support this hypothesis, since

improvement is evidenced in the team-building-with-posting condition for all three production measures. As stated with Hypothesis 5 above, concentration on the clear and stated goal of safety with the implication of "doing things right" may have impacted this group's performance after the training workshop (Larson & LaFasto, 1989 and Bucholz, et al 1987). In addition, the posting and goal setting strategies provided additional reinforcement for behaviors which ultimately led to improved performance (e.g., Locke, 1968; Locke, et al, 1981; Anderson, et al, 1988; Locke & Latham, 1990b). Finally, although this workshop was technically longer than the posting-only workshop, it still was short enough to conform to the Wexley & Latham (1981) recommendation that training sessions be of short duration.

Summary of Findings

Back-up behaviors as a teamwork characteristic is correlated with other established teamwork characteristics such as interpersonal relationships, process, task and leadership variables. Identification of back-up behaviors in the team context is a means of linking teamwork characteristics to the task. This process is job-related, and salient to individuals at the primary production level of this organization. Acquisition of back-up behaviors can be fostered in this "real" working environment, just as it can for university sports teams and military teams undergoing training. The type of presentation, whether

through a team-building approach or simply definition and information sharing, is immaterial in this setting. The key ingredient is utilization of a feedback strategy regarding acquisition of back-up behaviors, rather than goal setting or goal setting with feedback strategies. The question can be raised whether the posting strategy is a type of goal setting and is addressed below (Implications of Study Findings).

We can conclude that fostering of other teamwork characteristics such as interpersonal relationships, team processes, and task identity require additional workshops in order to deal with salient issues one at a time and in more depth. This concurs with advice of many interventionists, (e.g., Kinlaw, 1991). However small the effort may seem at first, some improvement seen in groups receiving this intervention can be viewed as important (Varney, 1989). We would expect continued improvement over time.

Improvement on all measures for the posting-only condition participants illustrates a pattern across all three measures of team performance. This provides a clue for future training and team development activities. It is perhaps most appropriate to begin a long-term training endeavor (whose focus is on teamwork) with the one hour workshop. This workshop would consist of the following: defining a team, identifying back-up behaviors and providing follow-up observation and posting of counts of attained

behaviors. This workshop would then become the launching pad for other short duration workshops that deal with only one aspect of teamwork at a time. It would be appropriate to provide further observation and posting of other behaviors identified that might impact other aspects of teamwork attitudes (e.g., behaviors which indicate tolerance or respect). Improvement in team performance, as indicated by the production measures, provides another clue in establishing the link between attempts at improving teamwork and improving team performance.

Implications of Study Findings

Theoretical Implications. The results of the present study regarding acquisition of targeted back-up behaviors via goal setting and feedback strategies raises an issue regarding the nature of posted feedback. It would be appropriate for future research to examine the relationship between posting of performance feedback per se and information regarding outcomes of goal setting strategies. Locke, et al (1981) states that feedback regarding performance relative to the set goal is a factor in maintaining a high level of effort. The question remains: Does written feedback (specifically in a posting format) unconsciously induce goal setting in the recipient? Perhaps successful implementation of feedback strategies, (e.g., Anderson, et al, 1988) for improvements in performance have resulted in utilization of unstated but conscious goal

setting on the part of the participants.

Continued use of Varney's Teamwork Checklist (Survey) is warranted in light of the fact that responses over time provide clues that those teams that utilize processes for dealing with task or interpersonal challenges, and that display better interpersonal relationships and more participative leadership, continue to do so. New objectives should include the improvement of related skills for all teams, not just those who "need it" the most.

A strong correlation between back-up behaviors and other teamwork characteristics adds strength to the concept that back-up behaviors are an integral part of teamwork skills development. Identifying back-up behaviors may provide insight regarding the elusive link between teamwork and taskwork which has heretofore been used as illustration that "the whole is greater than the sum of its parts."

The results of the present study may have been influenced by some of the inherent difficulties associated with quasi-experimental research (such as operationalization of constructs, confounding variables, limitations placed on the methodology by the company, etc.). For example, the feedback process on back-up behavior attainment was referred to as a posting strategy. Although the concept was based on previous posting activities (Anderson, et al, 1988 and Peron, et al, 1989), public posting was not permitted in this particular setting. However, it was desired that the

notion of public posting be maintained for future training protocols (objective 2 of this research), hence the maintenance of the term.

Among constraints placed by the host organization on this research was one that required non-random assignment of subjects to conditions (participants were assigned to team-building groups based on responses to the Teamwork Checklist). Cook & Campbell (1976) suggest that no adequate statistical tests exist for the most frequently used quasi-experimental designs in which non-equivalent groups, whose pretest performance levels vary and who receive different treatments. Hakel, et al (1985) point out that the probability of organizational reality being revised to conform with behavioral science principles is near zero. What is needed are research techniques aimed at making behavioral science findings more organizationally applicable and therefore suggest further development of techniques for time-series experiments. However, the robustness of Analysis of Variance made this an appropriate statistic for use in this setting due to the limited number of teams available for study. Indeed, Komacki (1977) suggested that when conducting a study in an organizational setting, measurement of expected organizational and study interactions should be considered. This implies that the results of the present study can be used to assist others in improving methodological and analytical approaches at future

research attempts involving real work teams.

Finally, hypotheses 2, 3, 5 and 6 as they are stated, can be interpreted as null hypotheses. Since Hypotheses 2 & 3 (no improvement in teamwork characteristics, other than back-up behaviors, for team-building-only and posting-only groups) are supported, a powerful effect must be recorded (Cook & Campbell, 1979). In all cases, Scheffe's post hoc tests indicate the results are significant ($p < .05$), thereby sustaining the findings.

Practical Implications. Two important aspects of this type of training program (workshops of short duration aimed at improving teamwork characteristics and hence team performance) are its job-relatedness and its reasonable cost. The individuals comprising work groups and teams at the primary or first production level of any organization are typically very practical individuals. They are willing to learn new ways of improving their performance but, at the same time, need to see the job relatedness of the endeavor. Although intelligent individuals, they are rarely philosophical thinkers, so that team-building activities centered on "games" utilizing unrelated activities will be dismissed from consideration. As a result, they may attend a workshop but not participate sufficiently to acquire or employ the knowledge and practice the intended behaviors. The main objective of any training program is transference of new skills from the learning situation back to the job.

By focusing on the teamwork characteristic of back-up behaviors, the transformation of the teamwork/taskwork consolidation to team performance is strengthened. Since the back-up behavior concept is clearly job-related, the concept is well received in practice by targeted individuals.

Cost of training is a financial burden on any organization. Frequently when budgets are cut, formal training is one of the first items targeted for removal. However, the cost of not training, may in the long run be more financially burdensome due to eventual reduced performance (Garvin, 1993). The search for cost-effective training remains therefore, a critical issue. Because this approach requires a relatively limited time away from the job (up to three hours), minor paperwork based on the number of attendees, and the fees of only one trainer/observer who will likely be "in-house," benefits accrued far outweigh the costs. Anecdotal responses by team members to the concept of introducing teamwork skills to new employees in addition to taskwork skills was overwhelming positive. The responses affirm the concept that assuming teams will naturally develop teamwork skills wastes precious time and resources (Glickman, et al 1987). Although training for teamwork skills should not stop with the introduction and practice of back-up behaviors, it is a good place to begin the process of implementing short-term workshops which deal

with other processes necessary to on-going team development.

The ability to identify and focus on back-up behaviors related to safety has far-reaching implications for other organizations with work groups engaged in activities which are potentially dangerous. Fostering back-up behaviors related to safety approaches the problem from a positive direction and is therefore acceptable to team members, their representatives, and management.

Study Contribution

The first objective of this study was to improve team performance. Clues are present that can guide future endeavors in a similar direction and provide support for the concept that improved teamwork produces enhanced team performance. Further support is given to the concept of back-up behaviors as an integral part of teamwork. In addition, the use of a feedback strategy as a means of reinforcing targeted behaviors is affirmed and the question is raised regarding the similarity between goal setting and posted feedback for inducement of intended behaviors.

The second objective was to develop a short-term training program that would provide new employees the opportunity to begin assimilation into ongoing teams in a timely fashion. Utilization of the Teamwork Checklist with stable teams also provides insight into existing needs for development of short-term, but continuous, team development activities. This approach to teamwork enhancement reduces

the probability of wasting valuable team resources and time if team members are left to their own evolution of teamwork skills. Appendix F offers a protocol for an ongoing training program that addresses the recommendations and concerns of Garvin (1993) and Muchinsky (1990) and illustrates potential applications related to these findings.

The third objective was to provide data from both the Teamwork Checklist and the Performance Indicator for their continued development and psychometric testing. One goal of organizational psychology research is concerned with the study of people's behavior at work. Location of sites willing to participate remains a challenge. Location of sites with large populations and no restrictions is a greater challenge. Participation in research endeavors by numerous individuals at various sites becomes one method of securing larger samples from which broader conclusions can be generated. Data from this project are now part of that larger pool of information.

This research study has presented favorable evidence for the use of the teamwork characteristic of back-up behaviors in addition to goal setting and reinforcement of target ed behaviors as a training strategy. The results are encouraging for the implementation of cost effective short duration workshops that utilize this strategy to foster improvements in team performance at the organization's

primary level.

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APPENDIX A
Forms Presented to Management

1

Old Dominion University
Department of Psychology

Informed Consent

Project Name: Team Goal
Investigator: Roz Peron

Date: _____

This is to certify that I, _____ agree to participate in a study which is in part a scientific investigation for the educational and research program of Old Dominion University as well as a program designed to benefit me and my co-workers. This study is under the scientific supervision of Dr. Albert S. Glickman (Old Dominion University).

The nature of the investigation and my participation have been explained to me. I understand that my participation in this study may not be the same as a co-worker's participation, but that everything will be explained during a debriefing at the end of the study.

I have been given the opportunity to ask questions, and all such questions have been answered to my satisfaction. I also understand that answers to questionnaires will remain confidential with regard to my identity.

I may withdraw my consent and terminate my participation at any time, without penalty.

I also have the right to contact the Psychology Department Committee for the Protection of Human Subjects and/or the University Committee should I wish to express any opinions regarding the conduct of this study.

Date: _____ Signature: _____

Witnessed: _____

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University Microfilms International

APPENDIX B

Back-up Behaviors

Time 1

Time 2

;

VNG GASWORKER TEAMS
BACK-UP BEHAVIORS
VNG
CONSTRUCTION TEAMS

- S - Assist w placement of safety cones/signs
- A - Assist w storage of safety cones/signs
- F - Warn others of traffic
- E - Warn or route traffic (flag)
- T - Aim/hold fire exting. at hot pipe fixer
- Y - Assist others w fire suit, masks, ear

- D - Bring shovels, etc. for others
- I - Bring gloves, towels for others
- G - Pass shovel, digging tools to others
- G - Offer to take over/assist digging (10 min)
- I - Remind digger to watch for buried cables
- N - Help watch for buried cables
- G - Hold risers, shovels, roots, etc. aside
 - Mold dirt away from hole for digger
 - Help digger out of hole
 - Assist with refilling of hole and grading
- R - Help retrieve tools without instruction
- E - Help restore misc. objects without instruc.
- P - Pass tools to others without inquiry/instruc.
- A - Offer suggestions (eg., locating pipe, cables, leaks)
- I - Offer suggestions for repair, installation
- R - Assist with plotting and measuring

APPENDIX C
Job Analysis: Gas Worker

;

G
F
T

X

X

157
Production

1. Unlock the truck and bins with the keys as instructed to prepare the truck for the day's work.

	4.05	16.81
Frequency	<u>3.15</u>	11.87
	3.65	14.27
2. Fill the water cooler with ice water to prepare the truck for the day's work.

	4.63	21.95
Frequency	<u>4.54</u>	22.02
	4.64	21.99
3. Be sure there is adequate soap-test solution to prepare the truck for the day's work.

	4.79	21.94
Frequency	<u>3.69</u>	16.75
	4.14	19.29
4. Empty the truck's trash bucket to prepare the truck for the day's work.

	3.79	16.56
Frequency	<u>3.92</u>	14.78
	4.37	15.68
5. Check to be sure the tools and equipment needed for the day's work are on the truck by reviewing the day's work requisitions to prepare the truck for the day's work.

	4.58	19.28
Frequency	<u>2.54</u>	8.99
	3.38	13.72
6. Check the equipment on the truck, as instructed, to be sure equipment is secured on the truck.

	4.95	23.71
Frequency	<u>3.69</u>	17.30
	4.24	20.44
7. Complete the DOT's "Commercial Driving Checklist" upon instruction and according to specifications to prepare the truck for the day's work.

	4.89	19.02
Frequency	<u>3.15</u>	12.85
	3.52	15.80
8. Place warning cones and signs according to specifications and standards to set up the work site.

	4.95	24.21
Frequency	<u>4.89</u>	22.34
	4.11	23.32
9. Check the wheels of the truck using hard rubber chocks to secure the truck when parked.

	4.79	20.93
Frequency	<u>4.62</u>	23.10
	4.72	22.05
10. Select equipment to use by judging the layout of the work site, taking instructions, and exchanging information in order to decide which method to use to install the new service.

	4.53	19.80
Frequency	<u>2.12</u>	8.86
	4.37	13.86

158 product

- 11. Remove and organize the necessary tools and equipment from the truck upon instructions and according to guidelines taught on-the-job to set up the work site.

Frequency	$\frac{4.32}{3.85}$ 4.09	Importance	$\frac{4.47}{4.46}$ 4.97	19.31
				17.17
				18.28
- 12. Fill the truck's fuel tank, when necessary or upon instruction, at company site to keep the truck ready for use.

Frequency	$\frac{3.89}{4.38}$ 4.14	Importance	$\frac{4.58}{4.77}$ 17.82	20.89
			$\frac{4.68}{4.68}$ 19.38	
- 13. Fill the equipment fuel tanks, when necessary or upon instruction, at company site to keep the equipment ready for use.

Frequency	$\frac{4.16}{4.08}$ 4.12	Importance	$\frac{4.63}{4.85}$ 19.26	19.79
			$\frac{4.74}{4.74}$ 19.53	
- 14. Check supply requisitions for equipment inventory, upon instruction or according to guidelines taught on the job, to maintain the truck's stock of supplies.

Frequency	$\frac{4.11}{3.15}$ 3.63	Importance	$\frac{4.53}{3.92}$ 18.62	12.35
			$\frac{4.23}{4.23}$ 15.35	
- 15. Clean truck and equipment, upon instruction or as necessary, to maintain truck.

Frequency	$\frac{4.26}{4.38}$ 4.32	Importance	$\frac{4.21}{4.92}$ 17.93	21.55
			$\frac{4.57}{4.57}$ 19.74	
- 16. Drive truck, upon instruction and with proper certification, to the work site.

Frequency	$\frac{3.26}{3.07}$ 3.17	Importance	$\frac{4.47}{3.85}$ 14.57	11.82
			$\frac{4.16}{4.16}$ 13.19	
- 17. Complete paperwork (time sheets, requisitions, daily log), upon instruction, to keep a record of work day activities.

Frequency	$\frac{2.63}{1.92}$ 2.28	Importance	$\frac{4.16}{2.77}$ 10.94	5.32
			$\frac{3.47}{3.47}$ 7.91	
- 18. Place "no smoking" sign, when necessary, to make area safe.

Frequency	$\frac{3.21}{3.23}$ 3.22	Importance	$\frac{4.53}{4.46}$ 14.54	14.41
			$\frac{4.50}{4.50}$ 14.47	
- 19. Put on a fire suit, when necessary, to protect from possible gas ignition during emergency situation.

Frequency	$\frac{4.42}{4.38}$ 4.40	Importance	$\frac{5.00}{5.00}$ 22.10	21.90
			$\frac{5.00}{5.00}$ 22.00	
- 20. Remove fire extinguisher from truck when working on gas leaks during emergency situation.

Frequency	$\frac{4.63}{4.46}$ 4.55	Importance	$\frac{5.00}{5.00}$ 23.15	22.30
			$\frac{5.00}{5.00}$ 22.75	
- 21. Dig vent holes with shovel, upon instruction, to clear building of gas.

Frequency	$\frac{3.58}{4.23}$ 3.91	Importance	$\frac{4.84}{5.00}$ 17.33	21.15
			$\frac{4.92}{4.92}$ 19.24	

7/6

7

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	22.	Clamp off broken plastic line, using a squeeze-off tool to make safe a broken service or main.	159
G			
F			
T			
		Frequency $\frac{4.00}{2.23}$	Importance $\frac{4.89}{4.54}$ 19.56 14.66
			$\frac{4.72}{17.09}$
	23.	Use pipe locator box according to guidelines taught on the job to locate the main gas line.	
		Frequency $\frac{4.32}{3.38}$	Importance $\frac{4.74}{3.92}$ 20.48 13.25
			$\frac{4.73}{16.67}$
	24.	Handle probing rod, explosion meter (gas scope) upon instruction to pinpoint leak.	
		Frequency $\frac{4.11}{3.31}$	Importance $\frac{4.84}{4.31}$ 19.89 14.37
			$\frac{4.58}{16.99}$
	25.	Read and compare gascope (CGI) meter according to specifications to pinpoint leak.	
		Frequency $\frac{3.89}{3.00}$	Importance $\frac{4.79}{4.00}$ 18.63 12.00
			$\frac{4.40}{15.18}$
	26.	Exchange information with other workers as necessary to pinpoint leak.	
		Frequency $\frac{4.06}{3.54}$	Importance $\frac{4.53}{4.31}$ 19.30 15.26
			$\frac{4.42}{17.24}$
	27.	Operate purger/air hose upon instruction to purge gas from barholes.	
		Frequency $\frac{3.42}{3.08}$	Importance $\frac{4.58}{4.15}$ 15.66 12.78
			$\frac{4.37}{14.20}$
	28.	Use leak clamps upon instruction to place repair clamp on pipe.	
		Frequency $\frac{3.53}{2.77}$	Importance $\frac{4.74}{4.31}$ 16.73 11.94
			$\frac{4.53}{14.27}$
	29.	Apply soap-test water according to specifications to test for leaks.	
		Frequency $\frac{4.58}{3.77}$	Importance $\frac{4.95}{4.54}$ 22.67 17.12
			$\frac{4.75}{17.86}$
	30.	Pick up objects according to guidelines learned on the job to clean up area on job completion.	
		Frequency $\frac{4.84}{4.31}$	Importance $\frac{4.53}{4.69}$ 21.93 20.21
			$\frac{4.61}{21.11}$
	31.	Insert plastic pipe through existing line to repair leak or renew service.	
		Frequency $\frac{3.37}{2.77}$	Importance $\frac{4.74}{3.92}$ 15.97 10.86
			$\frac{4.33}{13.29}$
	32.	Assist others as needed to cap off old service upon retirement.	
		Frequency $\frac{3.189}{3.08}$	Importance $\frac{4.79}{4.15}$ 18.63 12.78
			$\frac{4.47}{15.60}$

product

	Frequency	Importance	
33. Assemble new riser upon instruction to renew leaking riser. ¹⁶⁰	$\frac{4.00}{3.38}$	$\frac{4.74}{4.38}$	$\frac{18.96}{74.80}$
34. Turn valves upon instruction to shut off gas.	$\frac{3.74}{2.54}$	$\frac{4.56}{3.92}$	$\frac{16.83}{9.96}$
35. Insert plastic pipe into old line upon instruction to convert low pressure line to high pressure.	$\frac{3.14}{2.63}$	$\frac{4.58}{4.03}$	$\frac{17.13}{8.78}$
36. Install and attach anode according to specifications to cathodically protect steel lines.	$\frac{2.38}{2.51}$	$\frac{4.37}{4.03}$	$\frac{11.49}{10.12}$
37. Use pipe-to-soil tester upon instruction to check cathodic protection on steel lines.	$\frac{3.23}{3.64}$	$\frac{4.84}{4.46}$	$\frac{15.60}{14.41}$
38. Read PSI gauge according to specifications to check pressure on newly installed mains and services.	$\frac{3.15}{3.45}$	$\frac{4.65}{4.59}$	$\frac{16.93}{15.84}$
39. Handle chipping hammer upon instruction to assist in cleaning pipe.	$\frac{3.79}{3.09}$	$\frac{4.38}{4.39}$	$\frac{13.50}{13.57}$
40. Insert powder into cadweld mold upon instruction to weld wire onto pipe.	$\frac{3.68}{3.54}$	$\frac{4.42}{4.23}$	$\frac{16.27}{14.97}$
41. Use cadweld equipment upon instruction to weld wire anode onto pipe.	$\frac{3.54}{3.61}$	$\frac{4.23}{4.33}$	$\frac{14.97}{15.63}$
42. Use cold and hot wrap materials upon instruction to put protective coating on pipe.	$\frac{3.45}{3.69}$	$\frac{4.63}{4.46}$	$\frac{18.29}{16.46}$
43. Operate propane gas equipment upon instruction to install primer and hot wrap on pipe.	$\frac{3.82}{4.22}$	$\frac{4.55}{4.78}$	$\frac{17.38}{20.17}$
	$\frac{3.60}{3.91}$	$\frac{4.00}{4.39}$	$\frac{14.40}{17.16}$
	$\frac{3.68}{3.69}$	$\frac{4.79}{4.69}$	$\frac{17.63}{17.31}$
	$\frac{3.69}{2.95}$	$\frac{4.74}{4.21}$	$\frac{17.49}{12.42}$
	$\frac{3.38}{3.17}$	$\frac{4.38}{4.30}$	$\frac{14.80}{13.63}$

with the N-5

161 Product

- 6
F
T
44. Paint mastic on irregular fittings according to specifications to protect from corrosion. 4.79 19.69
- Frequency $\frac{4.11}{4.08}$ Importance $\frac{5.00}{4.90}$ 20.40
45. Read service map and compare to physical surroundings according to guidelines taught on the job in order to locate main gas line. 4.53 13.09
- Frequency $\frac{2.89}{2.22}$ Importance $\frac{3.77}{4.15}$ 8.71
46. Use shovel, airspade, tunneling spade, or jackhammer according to guidelines taught on the job or by following instructions to dig a hole at the main line. 4.79 22.94
- Frequency $\frac{4.79}{3.92}$ Importance $\frac{4.77}{4.78}$ 18.70
47. Use a square point shovel and axe according to guidelines learned on the job in order to dig a receiving hole. 4.47 18.60
- Frequency $\frac{4.16}{4.77}$ Importance $\frac{4.15}{4.31}$ 15.65
48. Operate a trencher or backhoe according to guidelines learned on the job to dig a trench. 4.63 12.69
- Frequency $\frac{2.74}{2.08}$ Importance $\frac{3.08}{3.86}$ 6.41
49. Operate a compressor and thumper according to guidelines learned on the job to install a new service. 4.68 17.97
- Frequency $\frac{3.84}{3.00}$ Importance $\frac{4.00}{4.34}$ 12.00
50. Use a level on thumper by following guidelines learned on the job to install new service. 4.79 18.63
- Frequency $\frac{3.89}{3.15}$ Importance $\frac{3.92}{4.36}$ 12.35
51. Use a measuring wheel as learned on the job or as instructed to measure the distance to receiving hole. 4.16 14.02
- Frequency $\frac{3.37}{2.46}$ Importance $\frac{2.92}{3.54}$ 7.18
52. Lay pipe into trench according to guidelines learned on the job to install a new service. 4.84 20.91
- Frequency $\frac{4.32}{4.08}$ Importance $\frac{4.77}{4.81}$ 19.46
53. Use shovel and rake upon instruction to plant grass and/or install temporary cold patch. 4.32 18.19
- Frequency $\frac{4.21}{4.23}$ Importance $\frac{4.38}{4.35}$ 18.53
54. Handle pipe and coupling according to guidelines learned on job to connect riser. 4.58 18.32
- Frequency $\frac{4.90}{3.62}$ Importance $\frac{4.38}{4.48}$ 15.86

mean product

	<u>X</u>	<u>X</u>	
55.	Use wrench and valve upon instruction to install valve on the riser.		162
G F T	Frequency	3.79	4.47
		<u>3.85</u>	<u>4.38</u>
		3.82	4.43
			16.94
			16.86
			16.92
56.	Place fusion iron and saddle according to guidelines learned on the job to fuse plastic gas services.		
	Frequency	2.63	4.68
		<u>2.85</u>	<u>4.23</u>
		2.74	4.46
			12.31
			12.06
			12.22
57.	Tap pipe with a saddle fitting according to guidelines learned on the job to gas up service.		
	Frequency	3.16	4.63
		<u>2.92</u>	<u>4.31</u>
		3.04	4.47
			14.63
			12.59
			13.59

odu-tsk.djw

Foreman - 13

Gas worker - 19

Territory

Northern - 14

Southern - 15

Ocean View / Norfolk 2

VA Beach 1

APPENDIX D

Back-up Behaviors Data Collection Form

Time 1 and Time 2

1

BEHAVIOR	NAME		
S - Assist w placement of safety cones/signs			
A - Assist w storage of safety cones/signs			
F - Warn others of traffic			
E - Warn or route traffic (flag)			
T - Aim/hold fire exting. at hot pipe fixer			
Y - Assist others w fire suit, masks, ear			
D - Bring shovels, etc. for others			
I - Bring gloves, towels for others			
G - Pass shovel, digging tools to others			
G - Offer to take over/assist digging (15 min)			
I - Remind digger to watch for buried cables			
N - Help watch for buried cables			
G - Hold risers, shovels, roots, etc. aside			
- Mold dirt away from hole for digger			
- Help digger out of hole			
- Assist with refilling of hole and grading			
R - Help retrieve tools without instruction			
E - Help restore misc. objects without instruc.			
P - Pass tools to others without inquiry/instruc.			
A - Offer suggestions (eg., locating pipe, cables)			
I - Offer suggestions for repair, install			
R - Assist with plotting and measuring			
DATE	TIME	TEAM	BY
occurrence: 1 missed occurrence, refusal: 2			
Comments:			

BEHAVIOR

NAME

- S - Assist w placement of safety cones/signs
- A - Assist w storage of safety cones/signs
- F - Warn others of traffic
- E - Warn or route traffic (flag)
- T - Aim/hold fire exting. at hot pipe fixer
- Y - Assist others w fire suit, masks, ear
 - Assist with safety belt
- D - Bring shovels, etc. for others
- I - Bring gloves, towels for others
- G - Pass shovel, digging tools to others
- G - Offer to take over/assist digging (15 min)
- I - Remind digger to watch for buried cables
- N - Help watch for buried cables
- G - Hold risers, shovels, roots, etc. aside
 - Mold dirt away from hole for digger
 - Help digger out of hole
 - Assist with refilling of hole and grading
- R - Help retrieve tools without instruction
- E - Help restore misc. objects without instruc.
- P - Pass tools to others without inquiry/instruc.
- A - Offer suggestions (eg., locating pipe, cables)
- I - Offer suggestions for repair, install
- R - Assist with plotting and measuring

DATE TIME TEAM BY

occurance: 1 missed occurrence, refusal: 2

Comments:

APPENDIX E

Workshop Agenda and Evaluation Forms

**TEAM WORKSHOP A
VNG GASWORKERS
FALL 1992**

AGENDA

Three-hour Workshop

WHAT IS A TEAM

TEAM DIMENSIONS

TASK
PROCESS
INTERPERSONAL
LEADERSHIP

HEALTHY VS. UNHEALTHY TEAMS

BREAK

TEAMWORK CHARACTERISTICS:

WORKING TOGETHER

BACKING-UP

GOAL SETTING

BACKING-UP BEHAVIORS

EVALUATION FORM

EVALUATION

Based on the following scale, please rate this workshop:

1	2	3	4	5	
Strongly Disagree		Disagree	Neutral	Agree	Strongly Agree

- 1. Teamwork discussion dealt with most team issues _____
- 2. Team definition was a worthwhile process _____
- 3. The presenter was knowledgeable about team issues _____
- 4. The presenter was knowledgeable about my job issues _____
- 5. The presenter had annoying habits I found
distracting _____
- 6. It was difficult to identify back-up behaviors _____
- 7. This workshop was worthwhile _____
- 8. This workshop should have been longer _____
- 9. I will take new information/skills back to my job _____

Such as:

Suggestions to improve this workshop

Other comments

MANY THANKS FOR PARTICIPATING IN THIS RESEARCH

TEAM WORKSHOP B
VNG GASWORKERS
FALL 1992

AGENDA
One-hour Workshop

WHAT IS A TEAM

BACKING-UP

EVALUATION FORM

EVALUATION

Based on the following scale, please rate this workshop:

	1	2	3	4	5
Strongly Disagree		Disagree	Neutral	Agree	Strongly Agree

- 1. Team definition was a worthwhile process _____
- 2. The presenter was knowledgeable about team issues _____
- 3. The presenter was knowledgeable about my job issues _____
- 4. The presenter had annoying habits I found distracting _____
- 5. It was difficult to identify back-up behaviors _____
- 6. This workshop was worthwhile _____
- 7. This workshop should have been longer _____
- 8. I will take new information/skills back to my job _____
Such as:

Suggestions to improve this workshop

Other comments

MANY THANKS FOR PARTICIPATING IN THIS RESEARCH

APPENDIX F
Training Workshop Protocol

1

TRAINING PROTOCOL

Following is a suggested training protocol for use with teams and work groups at the primary level (first production level) of your organization. Training is based on elements which are salient and job related and therefore more easily transferred to the job and assimilated into daily work routines.

- Identify organization's objectives
- Confirm feasibility of objectives with immediate supervisors
- Examine job domain, identify typical back-up behaviors
- Determine methods to measure and evaluate results
- Collect pre-measures
- Implement training workshop of one-to-three hours duration which addresses team dimensions and focuses on identifying back-up behaviors
 - Stress common goal
 - Seek interactions in compiling back-up behaviors
 - Seek commitments to attain back-up behaviors (goal setting)
- Monitor behaviors on the job (half-day observation) and share results with incumbents (feedback)
- Collect post-measures
- Evaluate results
- Determine further training and evaluation