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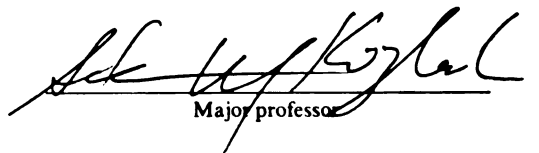
THE INFLUENCES OF SELF-REGULATORY PROCESSES ON
LEARNING AND PERFORMANCE IN A TEAM TRAINING CONTEXT

presented by

Stanley Morris Gully

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Psychology


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**THE INFLUENCES OF SELF-REGULATORY PROCESSES ON
LEARNING AND PERFORMANCE IN A TEAM TRAINING CONTEXT**

VOLUME I

By

Stanley Morris Gully

A DISSERTATION

**Submitted to
Michigan State University
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ABSTRACT

THE INFLUENCES OF SELF-REGULATORY PROCESSES ON LEARNING AND PERFORMANCE IN A TEAM TRAINING CONTEXT

By

Stanley Morris Gully

Little is known about the factors that influence team training effectiveness. Recent research has highlighted the importance of regulatory processes for skill acquisition and adaptability for individuals. The current study extends this previous work to training in team contexts. This study examines the effects of individual and team feedback, efficacy, and goals as components of a self-regulatory system leading to the development of team skills and outcomes.

A total of 267 participants in 89 teams performed a computer-based decision-making radar simulation in three person teams over two days. The study was a 2 X 2 X 6 factorial design, with individual feedback (present/absent) and team feedback (present/absent) fully crossed and six different task sessions. Participants were given five self-guided training sessions designed to provide opportunities to acquire individual and team skills. Prior to each session, participants provided measures of efficacy and set individual and team goals. After the training sessions but prior to an adaptability task, participants provided measures of declarative knowledge, structural knowledge, and affective/attitudinal outcomes. In the final task session, participants performed a highly complex task requiring adaptation of learned skills and knowledge.

Results were obtained from correlational, regression, repeated measures regression, multivariate regression, hierarchical linear modeling, ANOVA, repeated measures ANOVA, and MANOVA analyses. Support for the conceptual framework was obtained. Findings indicated that cognitive, skill, and affective/attitudinal training outcome variables were important to the performance adaptability of teams. These multidimensional training outcomes predicted performance adaptability before and after controlling for ability. Additionally, team-oriented training outcomes predicted performance adaptability even after controlling for individually-oriented training outcomes.

Findings also supported the effects of the self-regulatory variables of efficacy, goals, and feedback on training outcomes and performance adaptability. Higher levels of self-set goals, both individual and team, led to higher levels of performance adaptability and more positive training outcomes. Higher levels of efficacy were positively related to higher goals, more positive training outcomes, and higher levels of performance adaptability. Team feedback positively influenced performance adaptability and skill development over trials. Implications of findings for research on team training and the design of team training systems are discussed.

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To Mom and Dad.

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INTRODUCTION

Flight 173 had been in a holding pattern for approximately one hour at the end of a routine trip. The crew had been preoccupied with a noise heard while lowering their gear for landing. During this time, the first officer and flight engineer had warned the captain on four separate occasions that they were running out of fuel and needed to make a landing. As the first engine flamed out, the captain ordered the plane toward the landing field while demanding that the flight engineer explain the cause of engine failure. About 1815 PST, Flight 173 crashed into a wooded, populated area, killing 8 passengers and 2 crew members, and seriously injuring 21 passengers and 2 other crew members. The Safety Board believes that this accident exemplifies a recurring problem -- a breakdown in cockpit management and teamwork (National Transportation Safety Board, 1979, pp. 23-29, cited in Ginnett, 1993).

Recent trends in business, medical, aerospace, and military organizations have highlighted the importance of teams and pushed research issues involving them to the forefront of the research agenda (Ilgen, Major, Hollenbeck, & Sego, 1995; Sundstrom, De Meuse, & Futrell, 1990). A number of authors have noted that the success of organizations increasingly depends on the ability of individuals to work together productively as members of work groups or teams (Hackman, 1987; Peters, 1988; Salas,

Dickinson, Converse, & Tannenbaum, 1992; Sundstrom et al., 1990). This is true in part because many activities are accomplished by individuals working in teams and interacting through complex, technology mediated systems. These environments place high demands on the individual skills of operators and their capability to work together.

Modern task demands often exceed the capabilities of single individuals. Tasks are assigned to groups or teams because a single individual cannot be expected to handle the task alone (Cannon-Bowers, Oser, & Flanagan, 1992; Hackman & Morris, 1975, 1983; Salas et al., 1992). For example, nuclear reactor control teams have to process information from a large number of sources; some reactors may have more than 10,000 separate displays and a similar number of input controls. This task creates demands for information processing that far exceed that which any one person could handle. Thus, a typical control room is staffed by a team of four people -- two operators, a foreman, and a shift supervisor (National Research Council, 1991a).

The criticality of team functioning has been highlighted by instances in which breakdowns in team processes have led to disastrous consequences like the U.S. Vincennes incident (Barry & Charles, 1992) and major airline accidents (Foushee, 1984). In July 1988, the command and control team of the U.S.S. Vincennes, a Navy Aegis class cruiser, mistakenly shot down an Iranian civilian commercial airliner after identifying it as a hostile military aircraft (Barry & Charles, 1992). This event was highly publicized in the media and had many implications for international politics. Similarly, a number of highly publicized airline accidents have been found to involve poor teamwork and communication (Foushee, 1984; Kanki & Palmer, 1993; Prince, Chidester, Bowers, & Cannon-Bowers, 1992). Such situations have created a concern and interest in

understanding team processes and their relationships with team performance outcomes. As a result, people have begun to look to research for solutions to team-related problems.

It has been frequently stated that small group research has provided conflicting results and has been of limited usefulness for understanding processes and outcomes relevant to groups and teams in organizations (e.g. Collins, 1977; Driskell & Salas, 1992; Dyer, 1984; Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996; McGrath, 1986, 1991). This is true in part because several limitations and boundary conditions reduce the ability to generalize from research on one type of group or team to the understanding of groups or teams operating in a different environment (Goodman, 1986; Ilgen, Major, Hollenbeck, & Sego, 1993; McGrath, 1986). The organizational context, training, reward systems, technology, task demands, and other factors are likely to have significant impacts on the performance of work groups over time (Sundstrom et al., 1990). Thus, failure to explicitly recognize key boundary conditions of groups or teams may influence the applicability of research in one domain to that of another.

Goodman, Ravlin, and Schminke (1987) suggest that research is most useful when it is focused on a particular type of group or team because it takes into account the unique social processes, task demands, and environmental contexts within which certain groups or teams operate. The current study is focused upon understanding the learning and skill acquisition of members of teams in which expertise is distributed among team members, and information from a particular knowledge domain varies among different members. For example, a surgeon, surgical nurse, anesthesiologist, and anesthesia nurse each may have differing perspectives about the condition of a particular patient which could influence decision making processes related to operation procedures. This is an example of team

decision making under conditions of distributed expertise (Ilgen et al., 1995). Sundstrom et al. (1990) refer to such teams as action and negotiation teams; they are highly skilled teams with elaborate and specialized roles for members.

It is important to make clear the nature of the group or team under study to identify key characteristics which may or may not limit the generalization of findings from one domain to another. For the purpose of the current study, the term "team" will be used to refer to a distinguishable set of three or more people who interact interdependently toward a common and valued goal/objective/mission, and who have each been assigned specific roles or functions to perform (Dyer, 1984; Ilgen et al., 1995; Morgan et al., 1986; Salas et al., 1992). This definition also begins to highlight boundary conditions which can limit the applicability of small group research or previous work on group decision making to teams. Boundary conditions are "those conditions in any particular research study that restrict or qualify the conclusions that can be drawn from that study" (Ilgen et al., 1993, p. 264). Boundary conditions set limits on the generalizability of research results across settings.

Much of the group literature has focused on simple problem-solving or jury decision making (e.g., Davis, 1992; Kozlowski, Gully, McHugh et al., 1996; Thompson, 1993). Although clearly of importance and interest, research on jury decision making or creative problem solving does not adequately represent the kinds of tasks assigned to many teams operating within organizational contexts. For example, much of the group decision literature has focused on consensus oriented tasks with single decision events (see Davis, 1992 for a review) where members of the groups often have equal expertise or status within the group, and roles are not clearly defined for individual members.

In contrast, there are many teams in which members have unique knowledge or expertise relevant to team tasks and well-defined roles. Such teams often operate in task situations where problems are ill-structured and external contingencies are dynamic. Sometimes information is incomplete, conflicting, or ambiguous and goals can rapidly change. Additionally, decision points unfold over time with current decisions influencing future task states, and high work-load, time pressure, and high stakes can create considerable stress (Orasanu & Connolly, 1993; Orasanu & Salas, 1993). Examples of these kinds of teams include surgical staffs, aircraft crews, air traffic control teams, combat teams, and firefighting squads.

It can be seen from these descriptions that task contexts for action/negotiation teams with distributed expertise are quite complex. In these contexts, team effectiveness hinges on the ability of members to integrate their individual performances to meet interaction demands, and to adapt their behaviors in a coordinated fashion to meet shifting and ambiguous situational contingencies. Team performance is the result of a complex network of linkages among individual tasks, member roles, and the goals members have for themselves and the team (Kozlowski, Gully, McHugh et al., 1996). Within this perspective, effectiveness is based on the ability of members to meld their individual expertise into cognitive representations of task, role, and goal linkages. Such cognitive representations enable team members to ensure patterns of communication and member actions are congruent across positions in response to constantly changing task demands (Fleishman & Zaccaro, 1992; Kozlowski, Gully, Salas, & Cannon-Bowers, 1996). Thus, the teamwork or enabling skills which facilitate coordinated actions across team members

are a crucial component of team effectiveness (Kleinman & Serfaty, 1989; Kozlowski, Gully, McHugh et al., 1996).

It should be noted, however, that many of the distinctions made between different types of groups and teams are arbitrary and much overlap exists between the various distinctions which have been made (Ilgen et al., 1993; McGrath, 1986; Salas et al., 1992). Additionally, research on issues related to teams as they are defined here appears under the headings of teams and groups, with most work appearing under the heading of groups. The term group or team has been used interchangeably to describe what is being defined here as a team. Thus, this study will draw on findings from research on groups and teams to provide support for the theoretical model, and the term "team" will be used to apply to findings from research using groups or teams. It remains an empirical and theoretical question as to whether or not findings of interest from a particular domain will be applicable to research in other related areas.

The significance of teamwork for team performance outcomes has repeatedly been identified. Flight crew actions accounted for more than 70% of worldwide accidents involving aircraft damage beyond economical repair between 1959 and 1989 (Helmreich & Foushee, 1993). Similarly, industry-wide analysis showed that over 70% of aviation accidents result from crew coordination or communication problems, as opposed to a lack of individual technical skills (Orasanu, 1993). Furthermore, military aircrews have been found to suffer from many of the same problems. Failure to communicate critical information, poor management of crew resources, ambiguity over task assignments and priorities, and lack of assertiveness by junior crew members have been linked to accident occurrence in military aircrews. Prince and Salas (1993) found that information exchange

and workload priority and distribution accounted for the largest number of accidents in the Army tactical cockpit.

The importance of teamwork is not limited to flight crews. An in-depth survey of the merchant marine industry indicated that 40% of responders to the survey answered "yes" when asked if a dangerous incident ever resulted from a conflict between a pilot and captain. Likewise, interviews provided numerous incidents of confusion or contradictory orders from the pilot and master that resulted in casualties or near-casualties (Helmreich, Wiener, & Kanki, 1993). Also, teamwork has been found to be essential for power production teams in nuclear power plants, and strong parallels have been found between communication patterns in hospital operating room teams and cockpit crews (Helmreich et al., 1993). An estimated 75 to 80 percent of anesthesia mishaps have been linked to human mistakes, and many operating-room personnel do not have a consensus view of how team activities should be led and coordinated. Researchers are finding that many operating room errors result from interpersonal rather than technical deficiencies (Azar, 1994).

In spite of the importance of teams and teamwork, little is known about teams and how they develop skills enabling team performance (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Dyer, 1984; Hall & Rizzo, 1975; Nieva, Fleishman, & Rieck, 1978). Typically teamwork is assumed an automatic consequence of requiring individuals to work together, with little or no intervention required (Bowers, Salas, Prince, & Brannick, 1992). Yet we know that teams do not always work together efficiently, and the consequences of errors in these environments is often disastrous (Foushee & Helmreich, 1988). Teamwork is a complex set of behaviors and activities related to the interaction and adaptation of team members to achieve desired goals (McIntyre & Salas, 1995),

including communication, coordination, and cooperation (Bowers et al., 1992; Morgan et al., 1986; Rentsch, Heffner, & Duffy, 1994).

As Hackman and Morris (1975) noted, although thousands of studies of team performance have been conducted, we still know very little about why some teams are more effective than others. Hackman (1990) called for a paradigm shift to one that focuses on enabling conditions for teams and proposes that "there appear to be a number of organizational conditions which, when in place, increase the likelihood that a group's work will be characterized by sufficient effort, ample task-relevant knowledge and skill, and task-appropriate strategies" (p. 10). Similarly, Pritchard, Jones, Roth, Stuebing, and Ekeberg (1988) suggested that we need to develop team-based interventions in addition to the individually based interventions that have been used in the past. Much of the research on individual interventions will generalize to team-based interventions, but we need to take into account special characteristics of teams when developing team interventions.

Team training appears to be a promising intervention for developing teamwork and team effectiveness (Dyer, 1984; Salas et al., 1992; Salas & Cannon-Bowers, 1997; Sundstrom et al., 1990; Tannenbaum & Yukl, 1992). For example, Helmreich and Foushee (1993) noted that one of the most striking developments in aviation safety during the past decade has been the overwhelming endorsement and widespread implementation of training programs aimed at increasing the effectiveness of crew coordination and flightdeck management. In another study, a sample of 134 airline crew job experts rated teamwork behaviors as critical to their jobs, frequently occurring, and important to train (Cannon-Bowers et al., 1995).

Training is defined as a systematic or structured process through which attitudes, concepts, knowledge, rules or skills are acquired or refined (Andrews, Waag, & Bell, 1992; Goldstein, 1991). Team training focuses on the acquisition or refinement of attitudes, concepts, knowledge, rules, or skills that are specific to the collective environment that characterizes a team (Andrews et al., 1992). Andrews et al. (1992) note that in discussing team training, it should be made clear that it is the individuals, and not the "team" that learns.

It is useful to distinguish between team building and team training, both of which are interventions designed to enhance team effectiveness. Although team training and team building focus on similar concerns (e.g., enhancing communication, decision making, performance, etc.), the method of addressing these concerns differs (Tannenbaum & Yukl, 1992). Team building is often used in work groups with ill-structured goals and roles and where social conflict can become an important issue. Team building is a process intervention aimed at helping work groups examine and redefine goals and roles, clarify and rebuild interpersonal relationships, and improve social climate (Hackman & Morris, 1975; Tannenbaum & Yukl, 1992).

Team training, in contrast, occurs in teams that have well-structured roles and highly defined task demands. Although social skills may be of import in such teams, particularly early in team development (Kozlowski, Gully, Salas et al., 1996), the primary focus is on the development of task-related team interaction skills that enable effective task performance. Thus, team training is a set of theoretically-based instructional processes whereby team members can receive facts, concepts, and knowledge about team missions, objectives, tasks, procedures, and role expectations. Team training allows

members to understand and observe the knowledge, skills, and abilities required to perform highly interdependent tasks, to practice them, and to receive feedback on them (Salas & Cannon-Bowers, 1997).

Typically, training for members of teams operating in complex task environments has focused on developing the individual skills and technical proficiencies required to perform their tasks effectively. Although individual proficiencies are clearly crucial to team performance, they do not outweigh the significance of the teamwork and interactional aspects of the team in terms of compensatory, cooperative, and coordinative behavior (Hall & Rizzo, 1975). Bass' (1982) review of the team performance literature showed that, all else being equal, interaction processes within the team are what determine team performance. Furthermore, Brannick and Roach (1989) note individual competencies are important, but not sufficient, for successful team performance, and Hackman and Morris (1975, p. 49) state that "...something important happens in group interaction which can affect performance outcomes." Finally, an analysis of incidents reported to NASA's confidential Aviation Safety Reporting System concluded that "pilot error" documented in accidents and incidents was more likely to reflect failures in teamwork than deficiencies in "stick-and-rudder" proficiency (Helmreich & Foushee, 1993).

Unfortunately, although there is much research and theory with regard to training team members in the individual skills necessary to achieve team goals and missions, little research or theory exists on the training of those behaviors which bring individual skills and talents together into a smoothly coordinated and integrated team (Kozlowski, Gully, McHugh et al., 1996; Salas et al., 1992; Shiflett, Eisner, Price, & Schemmer, 1982). These team behaviors or team skills, are clearly essential to understanding team performance and

team effectiveness. As Shiflett et al. (1982) point out, without team-related behaviors, people and their associated skills are nothing more than aggregations, each performing their separate tasks. However, "when team functions are present, these small aggregations become unified teams, potentially operating as efficiently as any smoothly running machine composed of different but functionally related parts" (p. 1).

This study is focused on understanding aspects of team training that influence the development of knowledge and skills related to teamwork, adaptability of team training, and team performance. Unfortunately, there is a paucity of empirically tested theories of team performance (McIntyre & Salas, 1995; Morgan & Lassiter, 1992; Swezey & Salas, 1992; Tannenbaum & Yukl, 1992). Several researchers have noted that little exists to guide human resource practitioners who must design team training systems, and "empirically based prescriptions, guidelines, and specifications are virtually nonexistent for team training" (Cannon-Bowers et al., 1995, p. 333). Apart from a few case studies, we know little about appropriate content or design of team training programs (Dyer, 1984; Sundstrom et al., 1990), and few studies have addressed training strategies to ensure team effectiveness (Salas & Cannon-Bowers, 1997).

Similarly, there is little work on teams performing complex decision making tasks characterized by high work load, uncertainty, and multiple events influenced by early decisions unfolding over time. It is not clear how individuals make decisions in such contexts (Bandura, 1991), and it is less clear how teams make these types of decisions (Cannon-Bowers et al., 1995). The literature is virtually silent on how teams operating in complex decision making task environments can be trained (Orasanu & Salas, 1993).

For those few studies that have examined team training or team decision making, the focus has primarily been at the team level. The focus has been on what happens when teams are presented with an intervention or manipulation, and how teams differ as a result. Rarely has the focus been on processes and outcomes related to individuals within the teams. However, as pointed out earlier, teams do not learn; it is the cumulation of learning and performance of individuals within the team that enable effective team performance to occur. Thus, the current study will examine how individual learning and skill acquisition within a team training context feeds into team training outcomes and team performance.

Given the limited research on training effects on individuals within team contexts, one of the purposes of the current study is to draw on research on learning and training outcomes at the individual level and use findings to build a preliminary model of key processes leading to the acquisition of team skills. There is an emerging literature suggesting self-regulatory processes have strong influences on skill acquisition and training outcomes at the individual level (Etalapelto, 1993; Kanfer & Ackerman, 1989; Kozlowski, Gully, Smith, Nason, & Brown, 1995; Smith, Ford, Weissbein, & Gully, 1995). Self-regulatory mechanisms are considered to be of central importance for the successful learning and accomplishment of complex mental tasks (Etalapelto, 1993; Glaser & Bassok, 1989). The most proficient learners have been found to differ from the least proficient learners in that they are more aware of cognitive processes and they more effectively monitor errors and strategies during task performance (Glaser & Bassok, 1989). Similarly, Campbell (1989) noted the importance of self-regulatory processes and stated that we should pay more attention to trainees' goals, the variability and extent of

efficacy before and during training, self-regulatory behaviors of trainees, and socialization and team processes that influence trainees' goals and perceptions of self-efficacy.

A number of self-regulatory theories of motivation and learning have been developed, including goal-setting theory (Latham & Locke, 1991; Locke & Latham, 1990), control theory (Carver & Scheier, 1981, 1982, 1990; H. J. Klein, 1989; Scheier & Carver, 1982), social learning theory (Bandura, 1986, 1991), and resource allocation theory (Kanfer & Ackerman, 1989; Kanfer, 1990; Naylor, Pritchard, & Ilgen, 1980). Although these theories have emerged from a number of different theoretical orientations, certain commonalities exist among them. These commonalities can be used to develop our understanding of how self-regulatory processes influence attentional focus and skill acquisition in a team context.

The first commonality is that all of the self-regulatory theories mentioned involve goals or standards as key components of the self-regulatory process. The second is that they all involve the monitoring of a feedback loop so that one can track progress in relation to goals and standards. The final commonality is that most self-regulatory theories require a determination of whether current goals should be pursued or changed as a function of current environmental or system states. Perceptions of efficacy, or perceived task competence, have been found to be an important factor determining active pursuit of goals and the lowering or increasing of goals.

In spite of the importance of goals, feedback, and efficacy for learning and task performance at the individual level, many existing models of team effectiveness do not emphasize goals, efficacy, and feedback (Klein & Mulvey, 1995; Nadler, 1979). Most empirical research on goals has been done at the individual level (Locke & Latham, 1990;

O'Leary-Kelly, Martocchio, & Frink, 1994), with little work done examining the interplay between the influences of individual and team goals. Similarly, although many studies have been done on the effects of individual feedback (Ilgen, Fisher, & Taylor, 1979; Taylor, Fisher, & Ilgen, 1984), a number of researchers have noted that little is known about the influence of feedback on group or team performance (Barr & Conlon, 1994; Cusella, 1987; Nadler, 1979). Finally, almost all of the research attention on efficacy has focused on individual level self-efficacy, and there is very little work on the influence of team-efficacy on team performance (Cannon-Bowers et al., 1995; Lindsley, Brass, & Thomas, 1995; Prussia & Kinicki, 1996).

The purpose of the current study is to investigate the influence of self-regulatory mechanisms on individual and team training outcomes. However, applying self-regulatory concepts to learning in a team context requires an understanding of the complexities that multiple levels of focus can bring to the training environment. Skills needed at the individual level may be different from skills required to achieve training outcomes at another level of analysis (Ostroff & Ford, 1989).

In sum, the purpose of this study is to (1) draw on training research at the individual level and on group or team research to identify key outcomes of training that influence team performance; (2) use self-regulatory models of learning and performance at the individual level to develop an integrated model of learning and performance in team contexts; (3) describe the influence of goals, feedback, and efficacy on self-regulatory processes that lead to the acquisition of knowledge about teamwork skills; and (4) empirically test components of the integrated model to evaluate its usefulness for understanding the acquisition of teamwork skills and adaptable team performance.

REVIEW OF THE LITERATURE

To understand how self-regulatory mechanisms influence learning and skill acquisition in team training environments, it is first necessary to review training outcomes at the individual level. The first part of the literature review begins with an exploration of key training outcomes that facilitate adaptability and performance at the individual level. The second part of the review explores theories of self-regulation and identifies fundamental components of self-regulatory processes that may influence the training outcomes identified in the first part. The third part introduces issues related to levels of analysis and provides the conceptual basis for a consideration of self-regulatory processes in a team training context. The fourth part describes key team training outcomes using the multidimensional perspective of training outcomes developed in the first part. The final part of the literature review explores research on components of self-regulatory processes, including goal-setting, feedback, and efficacy, with consideration of findings relevant to the team level of analysis. The multidimensional approach to training outcomes and the identification of issues related to goals, efficacy, and feedback provide the conceptual foundation for the integrative model of regulatory processes and team training outcomes which is covered in the section following the literature review.

Training Outcomes

Ostensibly, the purpose of training is to develop knowledge and skills that can be applied to a variety of task contexts. Thus, one of the most important issues in any type of training endeavor is to understand training outcomes that can facilitate the adaptation of trained knowledge and skills to new situations, particularly to performance in non-training situations (National Research Council, 1994b).

Models of training evaluation (e.g., Kirkpatrick, 1976, 1987), transfer of training, or training effectiveness (e.g., Goldstein, 1991; Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991) have often defined training outcomes using a narrow perspective, focusing primarily on verbal knowledge or behavioral objectives (Kraiger, Ford, & Salas, 1993). Many training design systems begin with some specification of behavioral objectives or of key facts and points to be learned. Training is then designed to produce observable, measurable changes in trainee behavior or the ability to answer questions about basic principles, facts, or skills (Ford, Smith, Weissbein, & Gully, 1995; Kraiger et al., 1993).

Although the ability to demonstrate basic forms of learning may be important, it is essential to recognize that the ability to state basic facts is not synonymous with adaptable performance. The ability to adapt knowledge between training and application contexts is at the core of the frequently made distinction between learning and performance. One may learn to perform a task quite well during training, according to some stated criterion, but the acquired skills and knowledge may not be sufficient to perform effectively in a related but contextually different task environment (Kozlowski et al., 1995; National Research Council, 1994b). Similarly, the ability to state facts, rules, or principles does not ensure that a person can apply them efficiently and smoothly to related task domains that have

changed on important characteristics (Anderson, 1983; Glaser & Bassok, 1989). Thus, procedures that enhance performance and ability to state facts during training may or may not enhance retention, generalization, and application to alternative task contexts.

Conversely, procedures that introduce difficulties for the learner and impair performance during training may foster durable and flexible posttraining knowledge and skills (National Research Council, 1991b).

Declarative knowledge. The literature regarding expert-novice differences helps us to identify training outcomes that facilitate the application of learned knowledge to complex tasks. It is clear that basic knowledge of facts, principles, and rules is an important component of learning. Such basic knowledge is termed declarative knowledge (Anderson, 1981, 1983; Gagne, 1984). Declarative knowledge is acquired through processes that may be distinct from those leading to the acquisition of expert skills (Lord & Maher, 1991). Most theories of cognitive skill development state that declarative knowledge forms the foundation for the acquisition of more advanced knowledge and skills (Anderson, 1982, 1983; Glaser & Bassok, 1989; Kanfer & Ackerman, 1989). Thus, although declarative knowledge is important, focusing only on declarative knowledge as a learning outcome fosters a limited training perspective (Kraiger et al., 1993).

Declarative knowledge is often measured using multiple-choice, true-false, or recall tests (Kirkpatrick, 1987; Kraiger et al., 1993). Declarative knowledge is important as an outcome of training because it serves as a useful indicator of the degree to which trainees have acquired knowledge which will later influence the acquisition of higher order skills.

Knowledge structure. As declarative knowledge is acquired, it is organized and associated with other related or relevant concepts, rules, or principles. Additionally,

learners begin to focus more on procedural knowledge, or knowledge about how to perform activities or skills involving the use of acquired declarative knowledge (Anderson, 1982, 1983). Over time, trainees begin to develop meaningful structures for organizing knowledge, making it available for rapid implementation. Research has shown that experts have cognitive structures that are qualitatively different from novices (Chi, Feltovich, & Glaser, 1981; Chi, Glaser, & Farr, 1989), which allow self-regulatory activities to occur at a different level of awareness (Glaser & Bassok, 1989; Zimmerman, 1994).

Different terms have been used to describe knowledge structures, including mental models (Rouse & Morris, 1986), cognitive maps (Rentsch et al., 1994; Trochim, 1989), scripts (Gioia & Poole, 1984; Schank & Abelson, 1977), and schemas or schemata (Lord & Kernan, 1987). Although one can distinguish between the theoretical conceptualizations of different forms of knowledge structure, the primary issue is that knowledge becomes increasingly organized and associated into complex patterns and associations (Glaser & Chi, 1981; Lord & Maher, 1991). The advantage of such structures is that experts are able to quickly and fluidly access solutions, strategies, and courses of action.

A number of different techniques have been proposed to measure knowledge structures, including concept mapping (Rentsch et al., 1994; Trochim, 1989), clustering or multidimensional scaling techniques (Cooke & McDonald, 1987; Fitzgerald & Hubert, 1987), and other related algorithms (Schvaneveldt, 1990). Although the empirical evidence is just emerging, several studies have demonstrated the usefulness of these measurements of knowledge structure as training outcomes (Goldsmith & Johnson, 1990; Goldsmith, Johnson, & Action, 1991; Kraiger, 1993; Nason, Brown, Gully, & Kozlowski,

1995) and for predicting performance in task environments requiring adaptation of learned knowledge and skills (Kozlowski et al., 1995).

Skill-based. Knowing about something, whether it is declarative or structural in nature, is not the same as being able to execute a series of task behaviors smoothly and proficiently (Gagne, 1984). Novices may know a principle, rule, or specialized vocabulary without knowing the conditions of effective application or without being able to apply the knowledge quickly and smoothly to execute a series of responses (Glaser & Bassok, 1989). Similarly, although knowledge structures facilitate the application of highly integrated knowledge to the performance of some task, there is no guarantee that actions will be properly executed. Thus, knowledge is conceptually distinct from skill.

Theories of skill development suggest there are at least three stages to skill acquisition: (1) transition from declarative knowledge to knowledge about procedures (Neves & Anderson, 1981); (2) skill compilation which is characterized by faster, less error-prone performance and the integration of multiple separable steps into integrated acts; and (3) skill automaticity in which individuals are able to perform tasks smoothly, with little or no conscious thought (Gagne, 1984; Glaser, 1990; Kraiger et al., 1993). Skill automaticity enables people to attend to multiple activities or to activities at a different level of specificity. It is during the latter stages of skill acquisition that initial learning is translated into adaptive skills enabling application to different task contexts (Anderson, 1983; Kraiger et al., 1993).

Skill compilation can be measured and assessed through the observation of discrete behaviors of an individual, and by tracking the development of skills over time.

Compilation is also characterized by the ability of trainees to modify learned behaviors to

new task settings. Thus, compilation can be examined by evaluating the ability of trainees to generalize and adapt skills to fit demands of new task contexts (Kraiger et al., 1993).

Affective/attitudinal. Even as knowledge is acquired and skills are developed, application of trained knowledge and skills to environments requiring adaptation is still not ensured. Affective and attitudinal outcomes can influence the willingness and ability to apply knowledge and skills acquired during training (Kraiger et al., 1993). Gagne (1984) included attitudes as a training outcome, arguing that in addition to knowledge and skills, attitudes can also determine behavior or performance. Attitudes are defined as a general evaluation of some person, group, object, or issue (Petty, Priester, & Wegener, 1994). Some researchers have noted components of attitudinal formation are less enduring and influenceable by transient factors like current mood states (Schwarz, 1990), recent behaviors (Fazio, Herr, & Olney, 1984), and beliefs (Petty et al., 1994). Consequently, training can influence attitudes directly or indirectly through its impact on knowledge, beliefs, mood, and behaviors (Kraiger et al., 1993).

Affect can also be influenced by training, because affect is a perception of the general "goodness" or "badness" of something (Ortony, Clore, & Foss, 1987). Affect includes feelings like happiness, sadness, pride, and shame (Clore, Schwarz, & Conway, 1994; Ortony, Clore, & Collins, 1988). Carver and Scheier (1990) and Clore et al. (1994) suggest that progress toward or away from goals is an important event that can trigger affective reactions. Training can trigger cognitive appraisals of goal-directed action influencing affect, or provide stimuli in which goals become salient. Thus, training can provide experiences that can influence attitudinal evaluations and affective responses.

Self-efficacy is an important affective/attitudinal outcome of training (Kraiger et al., 1993). Self-efficacy refers to task specific perceptions of competence and it has been shown to relate to the application of trained skills in a number of different domains (Gist, 1987; Gist & Mitchell, 1992). As Wood and Bandura (1989) note, "there is a difference between possessing skills and being able to use them well and consistently under difficult circumstances" (p. 364). Success in the application of skills is determined in part, by a resilient self-belief that one has the skills and capabilities to exercise control over events to accomplish desired outcomes. Thus, greater efficacy leads to greater task persistence, even in the face of failure (Bandura & Cervone, 1986). Such resilience is important because learning often involves failure (Sitkin, 1992). Therefore, self-efficacy is expected to be strongly related to the learning and adaptation of training to a new task context (Ford et al., 1995; Kozlowski et al., 1995).

Training can be explicitly designed to change affect or attitudes, as in diversity training, multicultural training, self-awareness programs, and training for improving interpersonal skills or relationships. Training in such contexts encourages the internalization of values and ideas in order for cognitive or behavioral change to occur. There are a number of other areas in which important outcomes of training are attitudinal in nature. For example, training can perform a socialization function (Feldman, 1989), fostering high levels of organizational commitment, acceptance of norms, and internalization of values of an organization, department, or team. Thus, affective and attitudinal outcomes are an important component of training, influencing the acquisition of knowledge and the future application of knowledge and skills to varying task contexts.

Typically, relatively narrow conceptualizations of attitudinal and affective outcomes of training have been considered. For example, measures have typically included reactions to how well a particular training session was conducted or how much trainees liked a particular program or person (Kraiger et al., 1993). Attitudinal and affective measures, however, can be approached from a broader perspective including the measurement of general satisfaction and interest with a task, frustration with training, commitment to an organization, or self-efficacy. Each of these outcomes have the capability to influence the adaptation or generalization of training to a new context.

In conclusion, based on theory and research on individual training outcomes, there are at least three important domains that may influence the adaptation of trained knowledge and skills to new task contexts. The first domain refers to cognitive outcomes like the acquisition of declarative knowledge and the development of knowledge structures. The second domain is skill-based in nature, with the compilation of skills into smoothly flowing activities an important outcome potentially facilitating adaptability. The final domain focuses on affective and attitudinal outcomes which can affect the acquisition of future skills and knowledge, and which can encourage or retard the application of trained knowledge and skills to new task environments. The next section describes the importance of self-regulatory processes for the development of knowledge, skills, and attitudes in a training environment.

Self-Regulation

Self-regulation is a key process leading to the development of knowledge, cognitive structures, acquisition of new skills, and performance on complex tasks (Ford et al., 1995; Kanfer & Ackerman, 1989; Kozlowski et al., 1995). According to Means, Salas,

Crandall, and Jacobs (1993), self-regulatory skills may constitute the best candidate for training decision making skills that are generalizable across task domains. Similarly, research suggests an important factor that distinguishes experts from novices is that experts possess superior self-regulatory skills (Glaser & Bassok, 1989).

Einhorn and Hogarth (1981, cited in Abelson & Levi, 1985) noted "if one grants that behavior is goal-directed, it seems reasonable to assume that some ways of getting to the goal are better in the sense of taking less time, making fewer errors, and so on". Self-regulatory skills enhance goal directed behavior and decision making by influencing planning, monitoring, and the revision of goal appropriate behavior (Brown, Bransford, Ferrara, & Campione, 1983).

Self-regulation refers to the process whereby people activate and sustain cognitions, behaviors, and affects that are systematically oriented toward the attainment of goals (Meece, 1994; Schunk, 1994; Zimmerman, 1989). People form beliefs about what they can do, they anticipate likely consequences of actions, they set goals for themselves, and they plan and execute courses of actions that are likely to lead to desired outcomes. They then evaluate actual outcomes, form subsequent beliefs about what they can do and plan and execute future courses of action (Bandura, 1991). This regulatory process becomes more complex in situations that require individuals to balance a number of goals and tasks (Kernan & Lord, 1990; Vancouver, 1995). Little is understood about tradeoffs in terms of attentional resources allocated to pursuing a particular goal or set of goals, and the interaction of the person, task, and environment in these situations (Kernan & Lord, 1990; Locke & Latham, 1990; Wood, Bandura, & Bailey, 1990). To make sense of the complexity in these situations, models have emerged describing people as self-regulatory

living systems that influence, and in turn, are influenced by their environment (Bandura, 1991; Carver & Scheier, 1981, 1990; Karoly, 1993; Latham & Locke, 1991; Mitchell & Beach, 1990; Powers, 1973; Vancouver, 1995). Self-regulation has been defined as:

"...processes, internal and/or transactional, that enable an individual to guide his/her goal-directed activities over time and across changing circumstances (contexts).

Regulation implies modulation of thought, affect, behavior, or attention via deliberate or automated use of specific mechanisms and supportive metaskills. The processes of self-regulation are initiated when routinized activity is impeded or when goal-directedness is otherwise made salient" (Karoly, 1993, p. 25).

Among the theories that are merging into the self-regulatory framework are control theory (Carver & Scheier, 1981, 1990; H. J. Klein, 1989; Lord & Hanges, 1987; Powers, 1973), social learning theory (Bandura, 1986, 1991), goal-setting theory (Latham & Locke, 1991; Locke & Latham, 1990), resource allocation theory (Kanfer & Ackerman, 1989), and decision making models (Beach, 1990; Mitchell & Beach, 1990). Much of the benefit of the self-regulation framework is its ability to integrate previously separate theoretical orientations to provide a coherent understanding of the mechanisms influencing learning, behavior, and affect (H. J. Klein, 1989; Karoly, 1993; Vancouver, 1995).

Various self-regulatory frameworks have been proposed, and most of these deal in some form with how feedback or performance outcomes are used to make judgments or comparisons with regard to goals or standards that are set, and how this comparison in turn, affects future expectations, standards, and behavior (Bandura, 1986, 1991; Beach, 1990; Beach & Mitchell, 1990; Campion & Lord, 1982; Carver & Scheier, 1982; Hollenbeck, 1989; Hollenbeck & Brief, 1988; H. J. Klein, 1989; Latham & Locke, 1991;

Lord & Hanges, 1987; Taylor et al., 1984). Five major self-regulatory frameworks including goal-setting theory, control theory, social learning theory, resource allocation theory, and image theory, will be discussed and primary components of these frameworks will be integrated into a more generalized model of self-regulation. The purpose here is to identify general themes that transcend various models of regulation and motivation, providing a foundation for later discussion.

Goal-setting theory. Goal-setting theory is based on the notion that human behavior is purposeful and regulated by an individual's goals (Latham & Locke, 1991; Locke & Latham, 1990). A goal is the object or aim of some action. The theory states that the simplest and most direct explanation of why some people perform better than others is because they have different goals. Research has shown that specific, difficult goals lead to higher performance than do goals that are simple, general, or neither specific nor difficult (Locke & Latham, 1990). Self-regulation is implicit in goal-setting theory because the setting of goals and subsequent translation into action is a volitional process. However, goal-setting theory has not emphasized self-regulatory processes because goals are usually assigned in studies (Latham & Locke, 1991).

The self-setting of goals is a key aspect of the self-regulatory process. In situations in which people self-set goals, goals are found to be as effective for performance outcomes as goals that are assigned or set participatively. The setting of goals initiates self-regulatory processes by creating a discrepancy between current states and desired states. Positive discrepancies indicate that the current state exceeds the desired state while negative discrepancies indicate that the current state fails to meet a desired state. These discrepancies, in turn, initiate cognitions and actions relevant to the set goal. Thus, a goal

defines what constitutes an acceptable level of performance. When a negative discrepancy is found, the resulting negative appraisals in relation to the goal lead to problem solving, development of action plans, and maintained effort, persistence, and direction to attain the goal. Provided a goal is accepted and sufficient commitment to the goal exists, these processes will lead to higher goal attainment and performance than people who are without goals (Earley & Shalley, 1991; Locke & Latham, 1990).

Feedback is an important mechanism facilitating the achievement of goals (Earley & Shalley, 1991; Erez, 1977; Locke & Latham, 1990). Feedback is information about how one is doing, without which self-regulatory processes can break down. Bandura and Cervone (1983) compared a goal plus feedback condition to goals alone, feedback alone, and no goals or feedback. Using an ergometer task, they found that individuals in the goals plus feedback condition outperformed individuals in the other conditions. This finding is consistent with Locke and Latham's (1990) review of the goal-setting literature which concluded that feedback is important for goal-setting to work. Thus, although goals direct attentional focus, they have limited effects on performance when information is not provided on the usefulness of current actions or behaviors for the attainment of goals.

One of the key mechanisms of goals is the direction of attentional focus. The pursuit of goals affects what people attend to, the strategies they apply, and their adjustment to feedback provided in response to actions they take (Earley & Shalley, 1991; Locke & Latham, 1990). According to Earley and Shalley (1991), individuals utilize goals as a basis for cognitive, affective, and behavioral activity. Given the strong influence goals have on attention and subsequent planning and strategic activities, one would expect goals to have a strong influence on learning and skill development. For example, Rothkopf and

Billington (1975) and Rothkopf and Kaplan (1972) found that specific objectives were related to increased learning about goal relevant material and decreased learning about non-goal relevant material.

Some researchers have found that characteristics of goals affect regulatory activities during learning and subsequent persistence to learn (Meece, 1994). Activities of self-regulation during learning in response to goals include attending to and concentrating on specific types of information; organizing, coding, and rehearsing information to be remembered; establishing a productive work environment and using resources efficiently; holding positive beliefs about one's capabilities and the anticipated outcomes of actions; and experiencing pride and satisfaction with one's efforts (Schunk, 1994). Dweck and colleagues (Dweck, 1986; Elliott & Dweck, 1988) suggest that individuals oriented toward goals of mastering knowledge and skills are more likely to persist in the face of failure than individuals oriented toward goals of demonstrating higher performance. An emerging body of empirical evidence is supportive of goal orientation as a meaningful attribute of goals that affects learning and performance (Farr, Hofmann, & Ringenbach, 1993). However, mastery or performance orientations are only one possible characteristic of goals. Other characteristics, including difficulty and level of focus (individual or team) may also influence learning (Kozlowski, Gully, McHugh et al., 1996).

Social cognitive theory. Social cognitive theory (Bandura, 1986; 1991) deals with how the self-regulatory system engages in discrepancy production as well as discrepancy reduction and how social cognitive processes impact the setting of standards, self-observation and evaluation, and self-reaction. The basic process of social cognitive theory is the self-monitoring, self-judgment, self-reaction loop. Self-monitoring is the active

attending to and processing of information for a judgmental subfunction. The self-judgment function is one in which personal standards are compared to current behaviors and cognitions. The outcome of this judgment is self-reaction. Self-reactions provide the mechanism by which standards regulate courses of action; people pursue a course of action that produces positive self-reactions and refrain from behaving in ways that result in self-censure. These self-reactions in turn, affect future standard setting and self-monitoring subfunctions.

An important element of social cognitive theory is the notion of self-efficacy and its impact on the regulatory process. Self-efficacy is defined as "beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands" (Wood & Bandura, 1989, p. 408). Self-efficacy can impact the self-regulatory loop by influencing the self-monitoring and cognitive processing of various aspects of one's performance and the outcomes that result from them. Self-efficacy can also influence expectations for future states and the development of personal standards or goals. Thus, self-efficacy influences monitoring and judgment processes that affect motivation, effort, and performance outcomes. Resultant changes in performance outcomes can also impact self-efficacy perceptions which then feed back into the regulatory loop and affect future outcomes (Bandura, 1986, 1991; Kanfer & Ackerman, 1989; Wood et al., 1990).

Important aspects of social cognitive theory involve the setting of personal standards, the tracking of information or feedback relevant to standards, and reactions to discrepancies between standards and current outcomes. Additionally, self-efficacy is hypothesized to be an important predictor of reactions to discrepancies. When efficacy is

high, responses to negative discrepancies may involve persistence and pursuit of current goals. When efficacy is low, responses to negative discrepancies may take the form of goal reductions. When discrepancies are small or positive, high efficacy may result in the proactive setting of higher goals or standards, resulting in higher levels of performance (Bandura, 1991; Locke & Latham, 1990).

Resource allocation theory. Kanfer and Ackerman (1989; Kanfer, Ackerman, Murtha, Dugdale, & Nelson, 1994) have developed a theory of skill acquisition integrating theories of motivation and ability into a unified framework. Their theory is built in part on work by Naylor et al. (1980), Bandura (1986), and Anderson (1985). According to their theory, task performance can be determined by individual differences in attentional resource capability, task demands on attentional resources, and the self-regulatory processes by which people allocate attentional effort across activities (Kanfer, 1990).

A growing number of studies have demonstrated that the typical positive effect of difficult, specific goals on performance may not hold for novel and complex tasks (Earley, Connolly, & Ekegren, 1989; Earley & Shalley, 1991; Kanfer & Ackerman, 1989; Wood, Mento, & Locke, 1987). According to the resource allocation model, specific and difficult goals stimulate self-regulatory processes, such as self-evaluation and self-monitoring. Self-monitoring refers to "an individual's allocation of attention to specific aspects of one's behavior as well as the consequences of the behavior" (Kanfer & Ackerman, 1989, p. 662). Self-evaluation involves a comparison of current performance with a desired goal state. The size and direction of goal-performance discrepancies interact with self-efficacy and affective reactions to influence subsequent allocation of effort.

Although self-regulation can increase performance by increasing on-task effort, it can also hinder learning and performance because self-regulatory processes themselves demand attentional resources. Self-regulation requires the constant monitoring of task performance relative to a goal and the adjustment of one's behavior in relation to perceived discrepancies between desired goal states and one's current performance. Thus, specific difficult goals should facilitate performance for those with the resource capabilities to perform and learn about a task while simultaneously engaging in the self-regulatory process. Specific difficult goals should hinder performance for those without the resource capabilities to simultaneously attend to task and self-regulatory demands.

Empirical studies have provided support for this framework, explaining how goals interact with feedback and resource capabilities to influence learning and performance (Kanfer & Ackerman, 1989; Kanfer et al., 1994). An important finding is that goals can influence performance, learning, and affective reactions in a skill-acquisition environment. These reactions, in turn, can influence subsequent skill-acquisition. The resource allocation view has several major components, including resource capability, goals, feedback loops, mechanisms responding to goal-performance discrepancies, and self-efficacy. These components interact to affect learning and performance on tasks of varying complexity.

Image theory. Image theory (Beach, 1990; Beach & Mitchell, 1990; Mitchell & Beach, 1990) is a regulatory model which deals with the process of decision making. Mitchell and Beach posit that decisions are made based on the extent to which the current situation and alternatives fit with "images". Images are similar to heuristics or schema.

There are three types of images posited by Beach and Mitchell:

- (1) **Value image:** The decision maker's imperatives, guiding beliefs, values, etc. The collective term used for the constituents of the value image is principles.
- (2) **Trajectory image:** The future toward which the decision maker aspires. The collective term used for constituents of the trajectory image is goals.
- (3) **Strategic image:** The way in which the decision maker attempts to attain the various goals is located in the trajectory image. The collective term used for constituents of the strategic image is plans. Plans are defined as abstract schemata that are composed of specific acts, called tactics and forecasts.

In their theory, two types of decisions can be made with regard to images: adoption decisions and progress decisions. Adoption decisions involve whether to add new goals or plans to the trajectory and strategic images. For single decision candidates, a simple adoption or rejection compatibility test occurs. For multiple decision candidates, the compatibility test eliminates all possibilities that do not meet a threshold value for compatibility with existing images. If there is only a single remaining candidate, then it undergoes a simple adoption/rejection decision. If there are multiple surviving candidates, then the best candidate is adopted after a profitability test.

Progress decisions are made by comparing images of the desired system state to the perceived current state using the compatibility test. The output of the compatibility test is to decide whether to stay with the status quo or to change plans or goals. If the decision is to stay with the status quo, then future system states will be compared with the images retained as a result of the progress decision. If the decision is to change plans or goals, then a new image or set of images may replace the old ones. In this case, future system

states will be compared to the new images adopted. Image theory is similar in many respects to recognition primed decision theory (G. A. Klein, 1989, 1993), and March and Simon's (1958) notion of satisficing decisions. These theories recognize that people cannot search or weigh all possible alternatives given a particular decision situation. Instead, people search until they have found one, two, or a few alternatives that meet or exceed a criterion of acceptability and then they select that alternative. In this sense, they are matching their images (alternatives) with the situation. Kahneman and Tversky (1973) similarly postulated that people use heuristics to guide their decision making behavior.

In image theory, feedback mechanisms are not explicitly modeled, but they are crucial to the decision process. In order to make an adoption or progress decision, one must have feedback, or information about the current state of affairs. The outcome of a progress decision, in turn, affects the goals of the trajectory image and the plans and tactics used to pursue them in the strategic image. Again, fundamental components of this regulatory theory include goals, feedback, and a decision mechanism related to the setting of future goals or for determining actions and behaviors that will lead to desired goals.

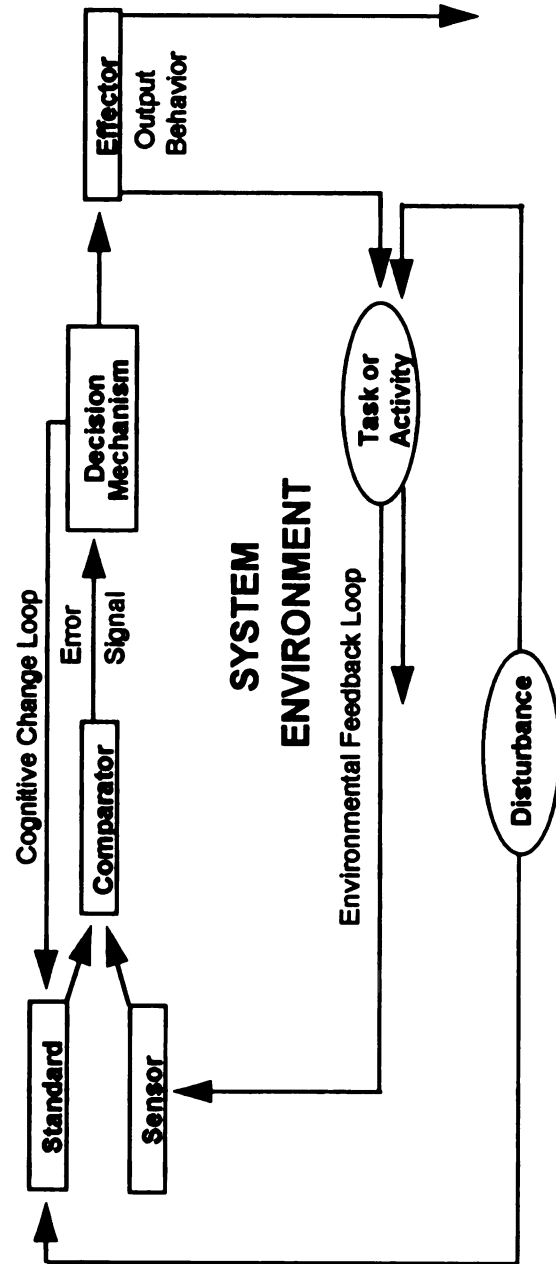
Control theory. Control theory also deals with self-regulation and comparison processes related to goals and feedback. In its original inception, control theory was built around cybernetic control principles and the negative feedback loop (Powers, 1973; Carver & Scheier, 1981). Self-regulation refers to a discrepancy reducing feedback loop in which a comparison between one's standard and perceived outcomes results in cognitive and behavioral output directed toward the reduction of discrepancies between standards and the perceived state of affairs (Kanfer, 1990). In control theory, the purpose of the regulatory system is to reduce negative discrepancies between goals and desired states.

There are four distinct components present in most control theory models: (1) a referent standard or goal; (2) a sensor or input function; (3) a comparator; and (4) an effector or output function. In the control theory feedback sequence, an input is perceived by the sensor, which sends a signal to the comparator. The input is compared to the standard by the comparator and if this comparison reveals a discrepancy, an error signal is generated. The system will then take some action via the effector which will serve to reduce the discrepancy. Some models have included a decision mechanism, which is a fifth component (Campion & Lord, 1982; Lord & Hanges, 1987; Powers, 1973). The decision mechanism functions to decide whether an attempt will be made to modify the environment via some effector function or whether the standard itself will change. Figure 1 illustrates one of the more complex versions of the control system loop.

The basic loop of control theory is analogous to how a thermostat functions. A particular temperature is set, and then cooling or heating systems are activated when temperatures deviate too far from the standard. However, it is important to recognize that goals and feedback involve much more than a mechanical sensing of the environment. In more recent incarnations of control theory, goals can be flexible and proactively changed, feedback is actively processed and interpreted, and there are alternative methods of reducing discrepancies (Lord & Hanges, 1987; H. J. Klein, 1989; Taylor et al., 1984).

It is clear from the self-regulation frameworks presented above that there are certain commonalities in the sense that they all contain some form of the following ideas:

- (a) Standard, goal, or image: The desired state to be maintained or achieved.
- (b) Sensing or monitoring: Measuring or gathering important information relevant to the standard, goal, or image. Attending to feedback.



Adapted from Lord & Hanges, 1987

Figure 1. The Control System Loop

(c) **Comparison or evaluation:** Comparison of the incoming information (feedback) to the standard, goal, or image. This results in the identification of positive or negative discrepancies.

(d) **Decision mechanism:** The mechanism by which a person decides what future action to take. The outcome of this decision can result in proactive/reactive goal-setting and/or a change or realignment of actions leading to outcomes (e.g., plans, strategies, etc.). Self-efficacy has strong influences on reactions to positive or negative discrepancies, which feed into the decision mechanism.

(e) **Effector function or action:** A response or action mechanism by which a person interacts with an environment. It can consist of an increase or persistence in motivation or effort, a reallocation of resources, or some change in actual behavior. These actions implement the result of the decision process regarding goal-performance discrepancies.

The framework identified above serves to create a reciprocal causation loop with influences on outcomes unfolding over iterations. A standard, goal, or image is compared with the current state. If there is no discrepancy with the current state then the regulatory process may continue with little or no modification to current activities or behaviors.

However, goal-setting will not always be reactive in nature; goals can be set proactively as a function of cognitive and affective variables, so even in the absence of a discrepancy or with a positive discrepancy, goals can be changed. In the case where a negative discrepancy between the current state and the goal is detected some cognitive or behavioral action will occur.

One can lower a goal or change actions to reduce a negative discrepancy. If a new goal is selected, then this becomes the standard to which the current state is now compared. If a behavioral change is enacted, then a number of actions can occur to impact or change the environment. This can include an increase in effort, a redistribution of resources, or persistence in effort over time. Either a behavioral or cognitive change can result in reduction of the discrepancy between the goal or standard and the perceived state of the environment. Perceptions of efficacy can affect how negative discrepancies are eliminated. Persons high in efficacy are more likely to reduce negative discrepancies by enacting a behavioral change, while persons low in efficacy are likely to reduce such discrepancies by lowering the standard used for comparison (Bandura, 1991; Bandura & Cervone, 1983; Locke & Latham, 1990). Perceptions of efficacy also influence how goals will be proactively set. Persons high in efficacy are more likely to engage in proactive goal change (Bandura, 1991).

The basic regulatory framework can explain why setting specific, difficult goals leads to higher performance and why presenting feedback and goal-setting together is better than presenting either one alone (Erez, 1977; Locke & Latham, 1990; Locke, Shaw, Saari, & Latham, 1981). The interaction between goals and feedback for performance relies on the notion that if either a meaningful goal or feedback is missing, no discrepancy can be detected, resulting in no behavioral or cognitive change. Also, the framework suggests that specific, difficult goals result in better performance because ambiguous goals are poor standards against which feedback can be compared. If a goal is ambiguous, then any feedback can be interpreted as showing no discrepancy; conversely, specific, difficult goals result in higher performance because they provide an unambiguous and high

standard around which behavior is regulated. Thus, specific difficult goals are more likely to create a noticeable discrepancy when a lower level of performance occurs, leading to an increase or change in behavior output, provided the goal is retained (Campion & Lord, 1982; H. J. Klein, 1989; Lord & Hanges, 1987).

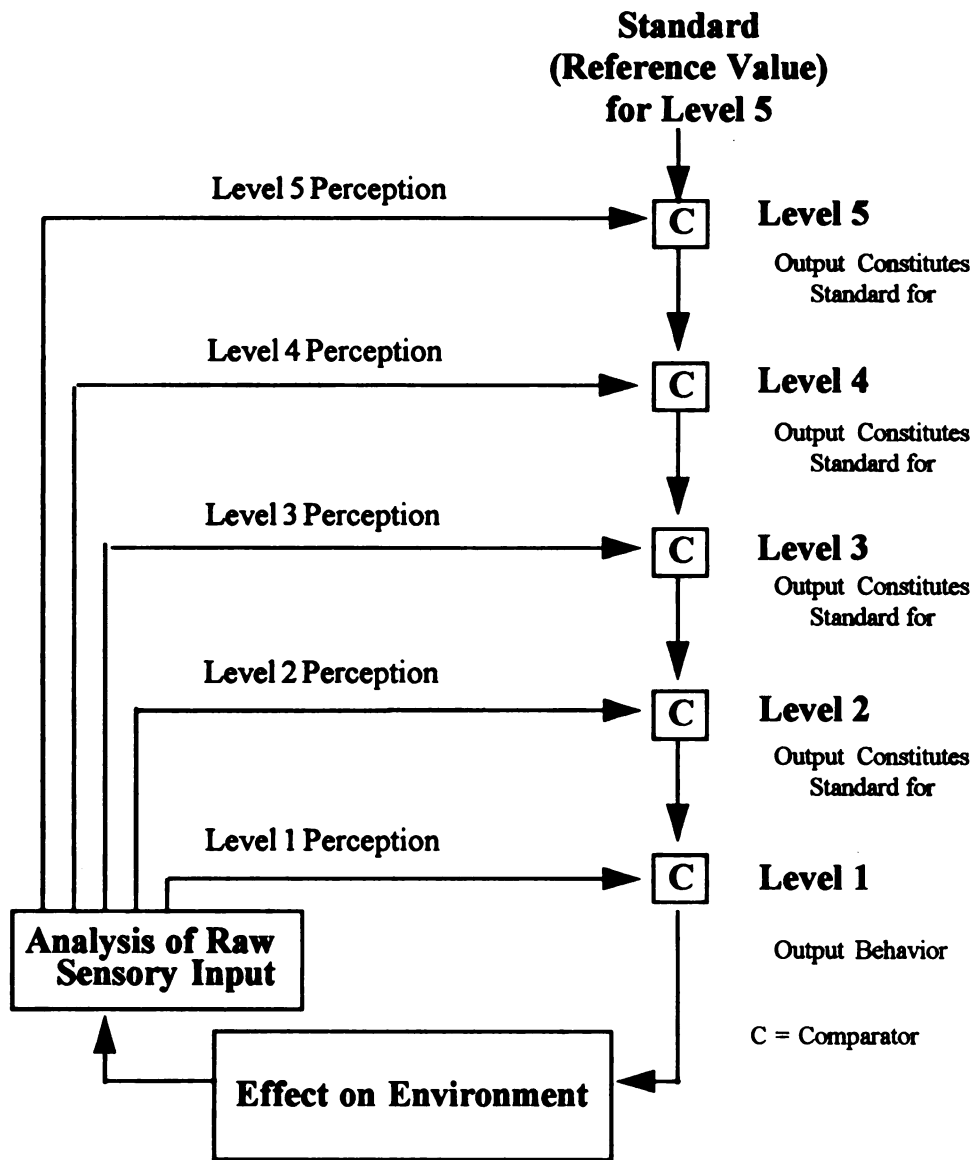
This framework also explains the difference between goal acceptance and goal commitment and why goal acceptance or commitment is important for goal-setting to be effective (Hollenbeck & Klein, 1987; Locke & Latham, 1990). Discrepancies can be reduced by either a change in effort and behavior or a change in goals. Goal acceptance refers to the initial use of a goal as a standard. If acceptance to a goal does not occur, then it will not be used as a standard for regulatory processes, and cognitive and behavioral actions will not occur in response to discrepancies. Goal commitment refers to the unwillingness to change a goal when confronted with discrepancies (Campion & Lord, 1982). Therefore, if goal commitment is low, then one will easily adopt a lower or different goal when faced with failure. Campion and Lord also note that certain cognitive elements may impact motivation through their effects on goal commitment or goal change. Perceptions of efficacy affect the level of goal acceptance or commitment to an assigned goal. This acceptance or commitment then leads to the selection of behavior change or goal change in response to goal-performance discrepancies.

Although this framework is relatively straightforward, it can be used to describe a wide variety of behaviors because goal and feedback mechanisms can be elaborated into a series of hierarchically organized loops (Carver & Scheier, 1981; Lord & Hanges, 1987; Lord & Kernan, 1987; Scheier & Carver, 1982). In the hierarchically structured model, the decision or behavioral output for a higher level loop generates the standard or goal for

the loop immediately subordinate to it and the output of this lower level loop in turn, will generate a standard or goal for the loop immediately subordinate. This is illustrated in Figure 2.

One can conceptualize the vector of subgoals leading to the higher level goal as a strategy for performance of the higher goal. For example, at the higher level, a person might have an image, goal, or a standard to be a good team member. This person must then decide what being a good team member means. Perhaps the output of the good team member decision would be to engage in effective communication behaviors. A decision would then have to be made regarding what effective communication entailed. This process would continue down the hierarchy until a particular behavior occurred. For example, the output of the hierarchy might be for the person to tell another team member that he or she failed to note an error in an aircraft tracking task. Feedback from that team member or from the team's performance can then be compared against the vector of goals describing effective team member behavior and adjustments in goals and strategies can then be made if necessary. This is illustrated in Figure 3.

There are a multitude of goals at any given level, with higher level goals defining the possible domain for lower level goals. Thus, each higher goal decision can create a series of lower goal states with a strategy for achieving the goal attached to each one. As people interact with a system, they begin to learn about these goal, strategy, and action relations. Attention to feedback and goals throughout the hierarchy will largely determine what a person learns, the skills they acquire, and their attitudes toward a particular person, group, object, or issue. Thus, different higher level goals will have strong effects on what is learned in relation to actions, behaviors, and outcomes at lower levels in the hierarchy.



Adapted from Carver & Scheier, 1981

Figure 2. A Hierarchy of Feedback Loops

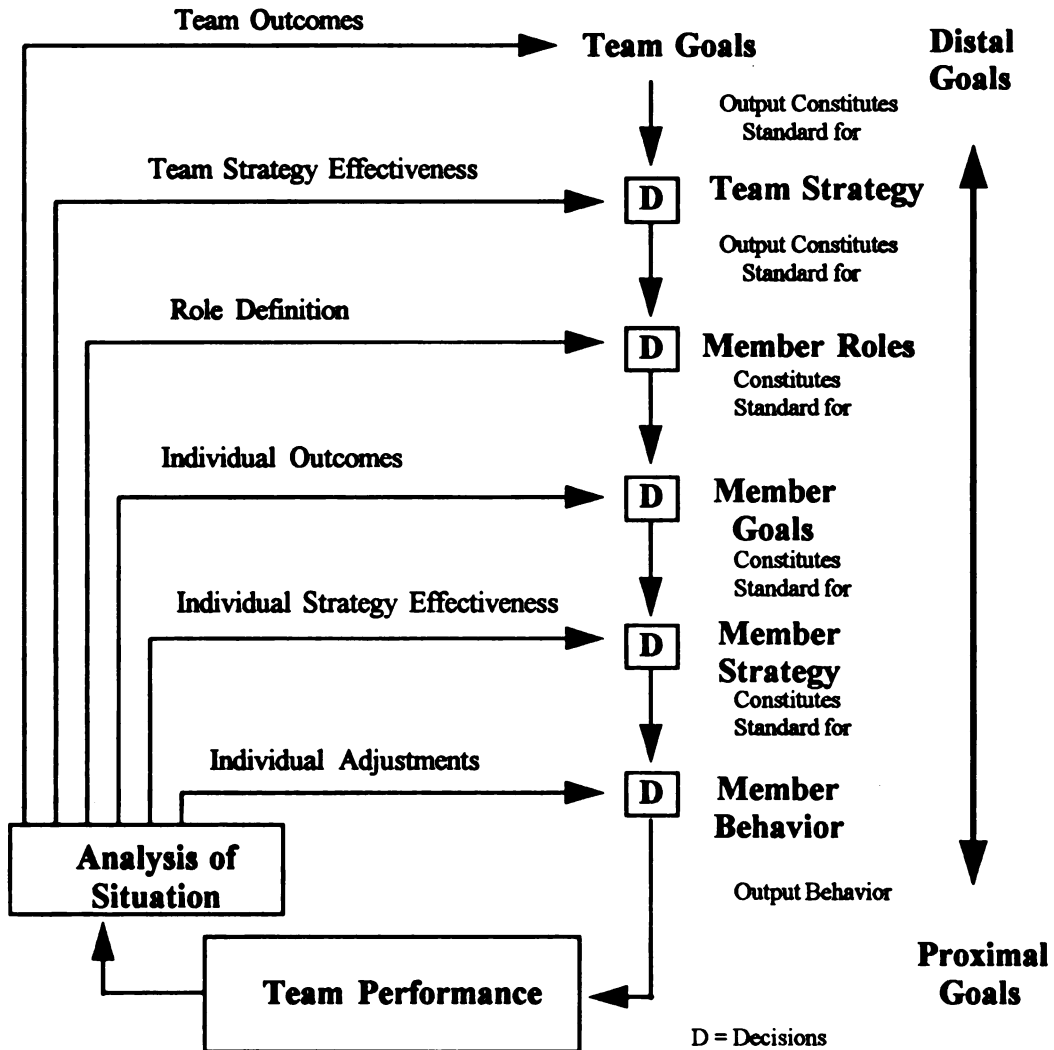


Figure 3. A Hierarchy of Team Feedback Loops

Decisions regarding the subgoal structure (strategy) can operate consciously or unconsciously at any level in the system. Although strategy selection may be a conscious process, with enough experience or practice, it is possible for strategies to become automatized (Earley & Shalley, 1991; Glaser & Bassok, 1989; Kanfer & Ackerman, 1989; Locke & Latham, 1990; Kraiger et al., 1993). When well-learned, the hierarchical goal structure discussed is similar to the concept of hierarchical knowledge structures held in memory that describe the appropriate interpretation and sequencing of events in conventional or familiar situations (Lord & Kernan, 1987). These knowledge structures are also similar to the value, trajectory, and strategic images described in image theory (Mitchell & Beach, 1990; Beach & Mitchell, 1990). People may use these structures to guide their behavior in complex situations, automatically applying goal/knowledge structures to fit the demands of the task. Such automatized processing is only interrupted when a major discrepancy is noted (Rouse & Morris, 1986; Cannon-Bowers, Salas, & Converse, 1993). When these knowledge structures are appropriate, they will facilitate rapid and accurate interpretation of information relevant to performance of a task. Early in team member role formation, prior to automatized functioning, the goal and knowledge structures of team performance described above have to be built and learned (Kozlowski, Gully, McHugh et al., 1996; Kozlowski, Gully, Salas et al., 1996).

The advantage of considering self-regulatory processes using a hierarchical perspective is that it makes explicit how knowledge, skills, and affect can be influenced. Higher level goals set the standard for action at lower levels in the hierarchy. The acquisition of basic knowledge is the foundation for action at these lower levels because one must understand basic concepts and how they relate in order to act upon them. As

long as commitment to higher level goals is maintained, actions will iterate through the self-regulatory loop, enabling basic concepts to become more highly organized and proceduralized. As knowledge structures are increasingly elaborated, facile and skilled performance becomes possible, and less attentional focus is required to monitor and pursue lower level goals. Attentional focus is then directed to goals at a higher level, enabling the rapid application of various strategies to a problem domain (Glaser & Bassok, 1989; Kraiger et al., 1993). Success or failure at developing skills, increasing knowledge, and attaining higher level goals can influence affect and attitudes. Thus, key outcomes of the self-regulatory process are knowledge, skills, and attitudes or affect. These are training outcomes that facilitate the adaptation of trained knowledge and skills to non-training or novel task environments.

Self-regulation involves cognitive structures and functions for perceiving, evaluating, motivating, and regulating behavior (Bandura, 1986; Bandura & Schunk, 1981). These structures and functions serve as filters to systematically build declarative knowledge about what is important to a goal or standard, which in turn, serves as a foundation for the development of more articulated knowledge structures which enable proficient and skilled performance. Self-regulation relies on the intervening processes of goal-setting and self-evaluative reactions, like self-efficacy (SEFF), to influence one's own behavior (Bandura, 1991). A series of studies by Bandura and Wood (Bandura & Wood, 1989; Wood & Bandura, 1989; Wood et al., 1990) demonstrated that SEFF perceptions influence the quality of analytical thinking and problem solving on complex tasks. This provides indirect support for the notion that self-regulatory mechanisms involving goals, feedback, and efficacy influence what and how people learn about a task.

In sum, the underlying model of self-regulation is a set of standards or goals, that in combination with feedback loops, yields a set of actions or outcomes which influence the environment. If a discrepancy exists between a perceived outcome and goal, an individual will attempt to reduce the discrepancy by either altering goals or applying resources to task-related behavior (Kanfer & Ackerman, 1989; H. J. Klein, 1989; Lord & Hanges, 1987). Multiple loops serve as an explanatory mechanism for more complex goal-driven processes (Kernan & Lord, 1990; H. J. Klein, 1989; Lord & Hanges, 1987). Individuals must: (1) act on and monitor many goals; (2) react to observable consequences of those actions and the environmental context; (3) assess strategies and resources needed to achieve the goals; and (4) enact strategies and plans to influence the environment (Vancouver, 1995). These activities result in the development of knowledge, compilation of skills, and generation of attitudes and affect. Together this creates a dynamic, but potentially understandable interplay of factors, all of which have strong implications for learning and skill acquisition in a training environment. Figure 4 summarizes the key aspects of self-regulatory mechanisms and their influences on training outcomes.

Thus far, we have identified declarative knowledge, knowledge structures, skills, affective reactions, and attitudes as important outcomes of training that may facilitate generalization of training to other contexts. Additionally, we have reviewed a number of regulatory theories that have relevance for the learning and performance of skills during training. Key components of the regulatory process involve feedback, goals, and efficacy. However, applying regulatory notions to the team context requires one to bridge individual level theories with team level outcomes. In order to do this, a brief review of

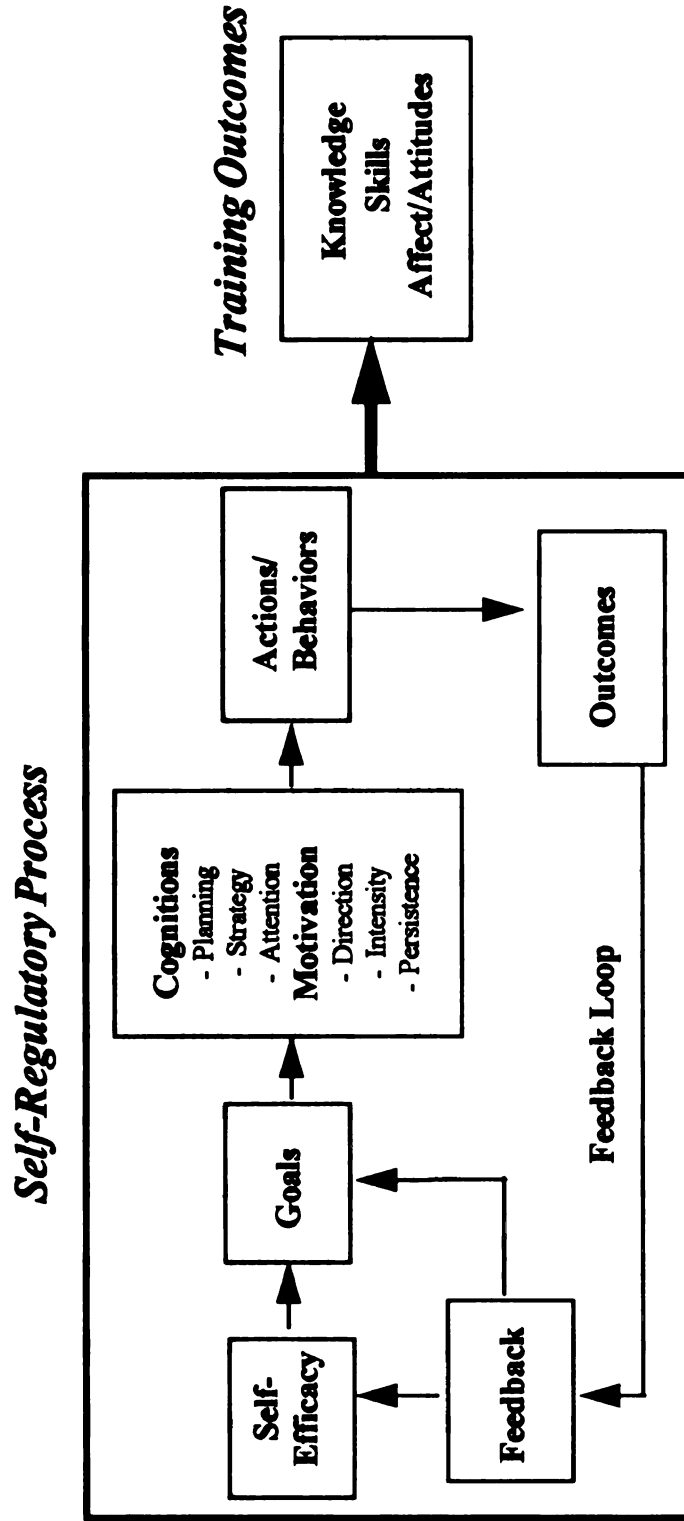


Figure 4. Basic Model of Self-Regulatory Influences on Training Outcomes

issues related to levels of analysis will be pursued, providing a foundation for understanding the function of goals, feedback, and efficacy in a team context.

Levels Issues

Research suggests that teams may take on characteristics that are more than the simple aggregation of individuals. Emergent properties of human interaction in the team environment create intricacies not apparent at the individual level. For example, some researchers have postulated an "assembly bonus effect" such that under particular task conditions, a group of individuals could perform at a higher level than the simple summation of the individual abilities would predict (Collins & Guetzkow, 1964; Hackman & Morris, 1975, 1983; Michaelsen, Watson, & Black, 1989; Steiner, 1972). Similarly, Tziner and Eden (1985) found that different combinations of ability levels in teams had effects on performance beyond that of the average ability level.

From a levels perspective, such research suggests that teams have characteristics that are distinct from individuals, and social systems involve complexities not apparent in individual level theories (Bandura, 1991; Katz & Kahn, 1978; Klein, Dansereau, & Hall, 1994). Thus, it is not immediately clear whether we can simply generalize from research conducted with individuals to make predictions about what will occur within groups or teams (Pritchard et al., 1988; Shea & Guzzo, 1987b). Teams must be studied as intact social systems in order to increase our understanding about them (Bandura, 1991; Katz & Kahn, 1978; Roberts, Hulin, & Rousseau, 1978).

Increasingly, a levels of analysis perspective has been utilized to organize and clarify conceptual thinking in numerous domains of interest (Klein et al., 1994; Kozlowski & Salas, 1996; Ostroff & Ford, 1989; Roberts et al., 1978; Rousseau, 1985). A level

refers to a plane of interest in a hierarchy of systems (Rousseau, 1985). Criteria for distinguishing levels in a system include differences in the complexities of organization, the physical size, number of constituent units, the physical proximity of units, and distinctive structures and processes characterizing units (Rousseau, 1985). Organizations, by their very nature, are multilevel. Individuals interact and work in dyads, teams, departments, and organizations. Accordingly, no construct in the organizational behavior domain is completely free of levels issues (Guzzo, 1995; Klein et al., 1994).

Most research on regulatory processes has taken place at the individual level. An important issue is that individual level findings cannot be immediately applied to the team level without potential misspecifications of theory (Klein et al., 1994; Roberts et al., 1978; Rousseau, 1985). In cases where components of the regulatory system have been studied at the team level, the entire level of focus has shifted to the team (e.g., Prussia & Kinicki, 1996). Findings at the team level involve complexities and processes not apparent at the individual level, potentially making findings at the team level unapplicable to the individual level. The current study is an attempt to bridge the gap between these two levels.

There are three primary issues requiring consideration in levels of analysis. First, the level of theory must be specified (Miller, 1978). The level or unit of theory describes the target that a researcher aims to depict and explain. It is the level to which generalizations are made (Klein et al., 1994; Rousseau, 1985). The level of theory often pertains to the variable being explained, but one must also specify the level of theory for the explanatory variables. Second, the level of measurement refers to the level of data sources. For example, self-report measures are at the individual level and team scores or win/loss records are at the team level. Some constructs, like team size, can only be at the

team level. An individual cannot have a size different from one with regard to membership. In other cases, constructs like goals can pertain to either individual or team level phenomena. Third, the level of statistical analysis refers to treatment of data. Data can be treated with teams as the units of analysis or with individuals as the units of analysis. For example, computation of mean scores across individuals for self-report data are sometimes used to perform analyses at the team level, but this can lead to aggregation bias if degree of consensus or within group correlations are not examined (James, 1982; Ostroff, 1993). Additionally, simple aggregation of individual values may not have theoretical meaning. Aggregation procedures must be guided by a theory of composition which specifies the shift in conceptualization of data across levels (Roberts et al., 1978). Researchers have stressed the importance of aligning the level of theory with the level of statistical analysis (Glick & Roberts, 1984; Klein et al., 1994; Rousseau, 1985).

A levels of analysis approach makes clear the importance of distinguishing between individual and team level constructs. The level of theory regarding a construct should dictate the level at which that construct is subsequently measured and analyzed (Glick, 1985; Mossholder & Bedeian, 1983; Klein et al., 1994; Rousseau, 1985). Failure to consider levels issues when conducting research can lead to misspecifications of measurement and analysis, fallacious inferences regarding effects at various levels, aggregation bias, and contextual fallacies (James, 1982; Klein et al., 1994; Robinson, 1950; Rousseau, 1985; Thorndike, 1939).

The level of theory developed here is focused on individuals within teams and their influences on both individual and team level outcomes. This approach is commonly called a cross-level model (Rousseau, 1985) because it focuses on the relationships between

variables at different levels of analysis. Typically, however, cross-level models focus on the influence of higher level entities on lower levels (Klein et al., 1994). In contrast, the current study will explore the influences of lower level variables on higher level outcomes, as well as the influence of higher level contextual variables on individual self-regulatory processes. This is an important shift in focus, because it is critical that we begin to understand how it is that loose collections of individuals become an integrated and highly coordinated team (Kozlowski et al., 1994). The cross-level perspective taken here links individual learning and skills to team level outcomes and performance.

There are three key issues revolving around this particular conceptualization of individual self-regulation and team training outcomes. First, the outcome of interest, adaptability of team training, is at the team level, and it is influenced by both individual and team level variables. Second, it is the individuals within the teams that learn. Teams are comprised of individuals, but higher levels like teams or organizations do not, by themselves cognize, behave, or react (James, Joyce, & Slocum, 1988). Individuals in teams perceive, learn, and react to stimuli, including important characteristics of the team (Hackman, 1992). Thus, self-regulatory processes and learning outcomes occur at the individual level, but these individual level variables combine in some fashion to influence team training outcomes. These combinations can be construed as team level variables, because they are some unique blend of the individual level outcomes in the team context. Third, characteristics of the team training context can have influences on individual self-regulatory processes that makes individual self-regulation outside the team context conceptually distinct from that occurring within the team context.

The integration of a levels of analysis perspective does several things. First, it clearly makes the point that some team level variables are not simple aggregations of individual perceptions. For example, team-efficacy (TEFF) is not simply the average of individual member perceptions of SEFF. Team-efficacy (TEFF) focuses on perceptions regarding the task specific capabilities of the team as a unit, while SEFF focuses on an individual's perceptions regarding his or her own capability (Guzzo, Yost, Campbell, & Shea, 1993; Lindsley et al., 1995). A number of factors unique to the team can influence perceptions of the team as a unit, while not affecting individual perceptions about the self. This creates a conceptual or theoretical separation between the two constructs. This statement is supported by research involving a hockey team which showed that team confidence was a better predictor of team performance than was an aggregation of individual confidence scores across all individuals (Feltz, Corcoran, & Lirigg, 1989).

Second, aspects of the team context, like presence of team feedback, can influence how individual self-regulatory processes unfold (Matsui, Kakuyama, & Onglatco, 1987). This, in combination with the first point, creates complexities that are unique to the team environment. For example, when evaluating the role of goals in learning during team training, one realizes that there are, at minimum, at least two goals present (Ilgen, Shapiro, Salas, & Weiss, 1987; Zander 1971, 1985). There are individual goals and there are goals for the team as a unit. Individual members may or may not share team goals, which can have important effects on the outcomes of team training.

In sum, regulatory processes can be understood at different levels of analysis. One level may focus on the individual, but complexities and unique characteristics of the team environment are lost. For example, a focus only on the individual level of regulation and

learning will ignore the influence of team goals, feedback, and knowledge about team interaction because they are not present. Another level of focus may be on the team as an entity. In this case, the purpose is to consider and evaluate how teams differ among themselves in terms of team characteristics and outcomes. However, by focusing only on the team level, the explanation of how individuals within teams combine to affect team level outcomes is lost. The current study is an attempt to bridge these two levels such that individual regulatory processes take place within the team context, and these processes combine in some fashion to influence individual and team level outcomes.

Prior to evaluating the literature relevant to self-regulation in the team context, it is important to consider aspects of training outcomes that are unique to the team level. Individuals can learn knowledge and acquire skills relevant to individual performance or to team functioning. The focus of the next section is to examine how the three primary domains of training outcomes, cognitive, skill-based, and affective/attitudinal, may differ in the team training environment relative to the individual training environment.

Team Training Outcomes

Typically, training has been focused on the individual as the unit of analysis (Feldman, 1989). Some research indicates that cognitive, skill-based, and affective variables may be crucial as training outcomes at the team level. For example, Feldman (1989) noted that much overlap exists between training systems and socialization in group or team environments. Training and socialization can develop knowledge and skills, create an understanding of role behaviors, and adjust values and attitudes of newcomers (Feldman, 1981, 1989; Van Maanen & Schein, 1979). Consistent with this perspective, Hackman (1992) stated that the stimuli that individuals encounter in a team context can

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influence their (a) informational states or knowledge; (b) behaviors; and (c) affective states. Similarly, Cannon-Bowers and colleagues have identified team competencies as (1) requisite knowledge, principles, and concepts underlying a team's effective task performance; (2) a repertoire of required skills and behaviors necessary to perform the task effectively; and (3) appropriate attitudes on the part of team members that foster effective team performance (Cannon-Bowers et al., 1995). In each case, cognitive, skill-based, and affective variables are considered critical factors for team effectiveness or important outcomes of training.

Team effectiveness is comprised of multiple components, including performance and the long-term viability of the team (Gladstein, 1984; Hackman, 1987; Sundstrom et al., 1990). Performance refers to the acceptability of output to those who receive team products, services, information, decisions, or performance events (Gladstein, 1984; Sundstrom et al., 1990). Viability entails members' satisfaction, participation, and willingness to continue to work together. According to Hackman (1987), team effectiveness is exemplified by high performance, the capability of team members to work together over time, and the fulfillment and satisfaction of member needs.

The training outcomes of knowledge, skills, and affect/attitudes provide a clear link to team effectiveness. Hackman and Morris (1975) stated that the major portion of variance in team performance is proximally controlled by three summary variables: (1) the effort brought to bear on a given task; (2) the task performance strategies used; and (3) the knowledge and skills of team members. According to Hackman and Morris (1975), if one can somehow control or influence these three summary variables, one could affect substantially the level of effectiveness of a team working on almost any task.

Each of these three summary variables are outcomes of training or are influenced by outcomes of training. Affective/attitudinal variables are apt to influence the effort brought to bear on a task. The more positive the affect or attitudes, the more effort applied. Obviously, knowledge and skills acquired through training will have an effect on the knowledge and skills of members. Finally, knowledge and skills will also influence task performance strategies. Strategy refers to collective choices made by members about how they will go about performing the task (Hackman & Morris, 1983). Included are choices members make about desirable performance outcomes and choices about how the team will go about trying to obtain these outcomes (Hackman & Morris, 1975). Members must have goals for the team, they must have the skill and knowledge to perform activities important to team outcomes, and they must have collective knowledge of goals and methods (lower-level goals) used to achieve these outcomes. Particular strategies can become well-learned, such that everyone in the team knows what they need to do (Gersick & Hackman, 1990). In such cases "...group interaction serves mainly to implement existing strategies already well learned by group members..." (Hackman & Morris, 1975 p. 335). Bass (1982) noted that a team will be more effective if its members are capable, skillful, and knowledgeable about what needs to be done. Thus, strategies can become well-learned and well-developed in the team training environment.

Therefore, research indicates that the same types of training outcome variables at the individual level may also be important at the team level. However, the emergent properties of the team context necessitate a shift in the content of the cognitive, skill-based, and affective training outcome variables (Kozlowski et al., 1994). For example, performance in the team context can be divided into task behaviors by individuals, like

specific job behaviors, and task-related behaviors oriented toward the team, like team interaction and coordination (Goodman, Ravlin, & Argote, 1986; Nieva et al., 1978). Learning skills for performing an individual task is different from learning skills relevant to team processes like coordination or communication. In the following section, the three training outcomes important to training adaptability will be reviewed with particular attention paid to how they differ between individual and team training contexts.

Skill-based. Team training must develop both individual and team skills (Dyer, 1984; Hall & Rizzo, 1975; Swezey & Salas, 1992). Individual skills refer to activities that could be or are performed independently of other team members, whereas team skills refer to activities/actions that are performed in response to the actions of other team members or that guide/cue the actions of other team members (Dyer, 1984). An example of an individual skill might be the competence to operate a console to collect information. An example of a team skill might be the competence to share the obtained information with other team members in a timely and coordinated fashion using communication protocols.

Team training has most often emphasized the learning of individual skills within a team setting, regardless of the nature of the team task (Briggs & Johnston, 1967; Converse, Dickinson, Tannenbaum, & Salas, 1988; Salas et al., 1992). This is partially due to the fact that team effectiveness requires individual members to acquire a fundamental level of competence in their specific individual tasks (McIntyre & Salas, 1995).

However, team effectiveness depends not only on individual performance but also on how well members interact with each other (Bass, 1982). This is highlighted by the conclusions of Helmreich (1991) who found in many airline accidents, the aircraft was mechanically capable of flying out of the situation, all crew members were well-trained and

in good health, yet the crew got into trouble (Hackman, 1993). Jones (1974), in a study of professional athletes, found 90% of baseball team effectiveness was predictable from the skills of individual team members, but only 35% was predicted by individual skills for basketball teams. Jones noted that basketball depends critically on teamwork.

Correspondingly, although technically proficient in individual tasks, high error crews experienced difficulties in areas of communication, crew interaction, and integration (Foushee, 1984). Thus, individual skills are necessary but not sufficient for team success on interdependent tasks (Salas et al., 1992), and process interactions among team members are significantly related to performance (Stout, Salas, Carson, 1994).

Teamwork is a complex set of behaviors including communication, cooperation, and coordination (Morgan et al., 1986). As task interdependence increases, requirements for coordination, communication, and cooperation also increase (Thompson, 1967; Saavedra, Earley, & Van Dyne, 1993). In action/negotiation teams with distributed expertise, cooperation, communication, coordination are key skills leading to team effectiveness (Glickman et al., 1987; Morgan et al. 1986; Salas & Cannon-Bowers, 1997; Sundstrom et al., 1990).

In a meta-analytic review, Freeberg and Rock (1987) found the average effect size for the influence of communication and coordination on accuracy was .31 and .48, respectively, across a variety of task situations. They also found the average effect size of communication, cooperation, and coordination on solution time was .47, .56, and .15, respectively. The effect of cooperation and coordination on cohesiveness was .54 and .14, respectively. Finally, they found the average effect size of coordination on product

quantity was .31. Thus, empirical evidence supports the notion that communication, cooperation, and coordination are important skills that influence team effectiveness.

Communication involves the exchange of information between two or more team members in a prescribed manner using proper terminology (McIntyre & Dickinson, 1992). Communication has been associated with differences in team performance (Stout et al., 1994). Voice data has demonstrated that flight crews that communicated more overall tended to perform better, and those crews that exchanged more information about flight status committed fewer errors (Helmreich & Foushee, 1993). Research has also demonstrated that more standard and more predictable forms of communication are related to lower error rates (Helmreich & Foushee, 1993). Additionally, Kanki, Greaud, and Irwin (1991, in Kanki & Palmer, 1993) found crews which share similar communication patterns appear to perform better as a team. Research indicates teams with communication which includes statements to (1) recognize problems, (2) state goals and subgoals, (3) plan and strategize, (4) gather information, (5) alert and predict possible outcomes, and (6) explain meaning, performed better when faced with adverse circumstances than teams that did not engage in such communication (Orasanu, 1990).

Closed-loop communication is an important method of ensuring that information is properly conveyed and interpreted. Closed-loop communication involves (1) the initiation of a message by a sender; (2) acceptance and acknowledgement by the receiver; and (3) confirmation by the sender to ensure that the intended message was received (McIntyre & Salas, 1995). One can see that communication is important to team performance, and a number of skills regarding proper or effective communication have to be developed during training in a team context.

Cooperation is another skill that is important for team effectiveness. Cooperation is acting or working conjointly with other members. The amount of cooperation in a group is defined by the degree to which group members integrate their interests and efforts to achieve mutual or common goals (O'Brien, 1968; Mitchell & Silver, 1990; Tjosvold, 1995). Cooperation includes the accomplishment of extrarole behaviors or actions that are not specified or expected and which facilitate the performance of others or the team as a unit (Weldon & Weingart, 1988; Weldon, Jehn, & Pradhan, 1991).

Cooperation skills are essential components of the team adaptation function described by Nieva et al. (1978). Included in this function are processes which occur as team members carry out strategies, make mutual adjustments, and complement each other in performing the task. Some cooperation skills include mutual evaluation and correction of error, and mutual compensatory performance. This includes processes by which team members perform tasks which are not typically defined as their responsibility (Shiflett et al., 1982). Members high in cooperative skills offer help, but only when other team members require it. They also pace their activities to fit the needs of the team and not their own needs (Alexander & Cooperband, 1965). Research suggests that skills in dynamically reallocating resources and workloads according to task demands and the ability of teammates are essential components of teamwork (Cannon-Bowers et al., 1995).

Cooperation has been found to induce higher achievement, productivity, and morale than competitiveness, especially on more complex tasks and problems that benefit from the sharing of information and ideas (Johnson, Johnson, & Maruyama, 1983; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Tjosvold, 1995). Similarly, Deutsch (1949) found that cooperation produced higher levels of performance and satisfaction than

did competition. Morgan et al. (1986) found that cooperative skills like performing tasks outside one's job, assisting others when they were having difficulty, and covering other members when they were overworked, are important skills that distinguish ineffective from effective teams. Mitchell and Silver (1990) found that cooperative feelings and behaviors mediated the influence of goals on task performance. Those teams that were high in cooperative strategies did better than teams low in cooperative strategies. Other cooperative skills may include mutual performance monitoring, which refers to observation of the activities and performance of other members, and providing error detection and correction when appropriate (McIntyre & Dickinson, 1992). Cooperation is influenced by team member knowledge regarding the strengths and weaknesses of one another, a positive orientation toward the team as a unit, and knowledge of the tasks and roles of other members (Alexander & Cooperband, 1965; McIntyre & Dickinson, 1992).

Coordination is another important team skill. Coordination involves the execution of individual member activities in a timely and integrated manner (McIntyre & Dickinson, 1992). Coordination refers to the temporal pattern and sequencing of behaviors relative to task demands (Kozlowski et al., 1994; Zalesny, Salas, & Prince, 1995). Effective team performance in complex task environments requires team members to integrate their actions in an orderly, timely fashion and to make their actions and intentions known to others. Tasks need to be completed simultaneously or in sequence, and they need to be completed at the appropriate times (Kanki & Palmer, 1993).

Experimental simulation has demonstrated that most problems and errors in air crews are induced by breakdowns in coordination rather than by deficits in technical knowledge and skills (Ruffell Smith, 1979, cited in Helmreich & Foushee, 1993; Kanki &

Palmer, 1993). Similarly, coordination on the part of the pilot, copilot, and overall team has been found to be positively correlated with their performance (Stout et al., 1994).

Nieva et al. (1978) state that the team organizational function involves processes necessary for members to perform their tasks in coordination. They include the processes by which team members decide who is to do what and when through the development of patterns or "programs" of coordinated behavior in response to the task environment. These include matching member resources to task requirements (division of labor); response coordination and sequencing of activities such that member activities flow smoothly and do not interfere; activity pacing which is related to response coordination; priority assignment among subtasks; and load balancing of tasks (Shiflett et al., 1982).

Coordination is not a characteristics of individuals. Rather, it is a characteristic of a team (Zalesny, Salas, & Prince, 1995). It should be noted, however, that there are individual determinants of coordination. If a set of responses and pattern of interactions occur repeatedly in a given task context, members are likely to develop and follow knowledge structures like schemas, scripts, or mental models to determine response sequences that are appropriate for specific situations (Cannon-Bowers, Salas, & Converse, 1990, 1993; Gersick & Hackman, 1990; Gioia & Poole, 1984; Kleinman & Serfaty, 1989; Zalesny et al., 1995).

At low levels of task and team knowledge and experience, team members are unlikely to have formed complex knowledge structures that can be used to facilitate problem identification, analysis, and solution generation (Chi et al., 1981; Chi et al., 1989; Wagner & Sternberg, 1986). Novice members must focus on coordination that involves basic task and interaction processes with frequent and explicit communication with other

members and monitoring of task activities to ensure proper sequencing of actions is occurring. As team members gain task and team experience, they also gain in knowledge. They develop task- and team-relevant schemas, scripts, and heuristics, which in turn, guide behavior and reduce cognitive load and demands for monitoring coordination of activities. Team coordination, then, is influenced by the more cognitive and behaviorally efficient routines incorporated into the team-developed knowledge structures (Cannon-Bowers et al., 1990; Gersick & Hackman, 1990; Zalesny et al., 1995).

The team skills of communication, cooperation and coordination do not encompass the entire domain of activities crucial to team effectiveness (see Cannon-Bowers et al., 1995 for a review). However, empirical evidence and theory exist to suggest that these three skills are important to team effectiveness in many contexts. Although the team skills described are important, such skills are typically not thought of as a characteristic of individuals. Rather, they are thought of as characteristics of a team. However, the ability of the team to share important information, sequence member activities, and adjust by redistributing work loads is predicated upon individual member knowledge and skills to engage in such actions (Zalesny et al., 1995). Thus, cognitive outcomes of training provide the foundation for the development of more complex team-related skills.

The cognitive approach to the study of teamwork is beginning to generate research interest (Rentsch et al., 1994). Team members must develop declarative and procedural knowledge of the cooperation, communication, and coordination aspects of teamwork. Individuals with low levels of team experience or knowledge will most likely be at the declarative stage. They will have some knowledge of teamwork, but they will not be flexible in the use of this knowledge, and they will be less likely to adapt team training to a

new task environment. Thus, declarative and procedural knowledge must be compiled into organized structures for members to engage in effective team interaction (Cannon-Bowers et al., 1990, 1993; Klimoski & Mohammed, 1994; Rentsch et al., 1994).

Cognitive. Studies of differences between experts and novices suggest the course of knowledge acquisition proceeds from a declarative or propositional form to a compiled, procedural, condition-action form (Anderson, 1983). Novices can state facts, rules, or principles without knowing when or how to apply them. Experts can “chunk” information together into cognitive structures that can be rapidly applied or adapted to various situations (Glaser, 1990).

As noted earlier, individual competencies are important for team performance (Brannick & Roach, 1989), and training in individual task proficiency is the foundation for an effective team (Collins, 1977). Novice team members must acquire and develop declarative knowledge about their individual tasks, and they must begin to organize this knowledge into complex structures that enable rapid application to changing task situations. For example, members must be able to identify key components of their tasks, and acquire basic knowledge about performing their tasks. As they learn about their individual tasks, they become increasingly facile and capable of attending to other aspects of their task performance environment (Kozlowski et al., 1994).

Similar acquisition of team declarative knowledge must occur to provide the foundation for the development of more complex team-related knowledge and skills. A key form of declarative knowledge important to team members is basic knowledge of the tasks of others with whom they interact during team operations (McIntyre & Salas, 1995). Cream (1974) demonstrated that each member of an aircrew team must possess accurate

expectations regarding the appropriate functional requirements of other crew members in order for them to perform effectively as a team (Cream, Eggemeier, & Klein, 1978). Similarly, Baker (1991) found lack of knowledge regarding other member roles negatively affected teamwork and task performance (Baker, Salas, Cannon-Bowers, & Spector, 1992). Other team knowledge requirements include an understanding of the nature of teamwork and teamwork skills; knowledge of overall team goals, objectives, and missions; knowledge about boundary spanning; knowledge about fellow members' roles and responsibilities; and cue-strategy associations (Cannon-Bowers et al., 1995).

As basic knowledge is developed and competence is attained, elements of knowledge become increasingly interconnected so that proficient individuals access coherent chunks of information (Glaser & Bassok, 1989). The content of knowledge becomes increasingly structured and integrated with past organizations of knowledge so that they are retrieved from memory rapidly and in larger units. For example, researchers have found that expert programmers' domain specific knowledge is organized into large hierarchical structures which have a qualitatively different organization as compared to the knowledge structures of novices (Weiser & Shertz, 1983; Wiedenbeck, 1985).

Such structures evolve and are modified or elaborated to facilitate more advanced thinking, and they enable forms of representation that are related to the ability to solve complex problems or perform complex tasks (Glaser & Bassok, 1989). These knowledge structures have been called schema (Lord & Kernan, 1987; Poole, Gray, & Gioia, 1990), scripts (Gioia & Poole, 1984; Schank & Abelson, 1977), and mental models (Johnson-Laird, 1983; Rouse & Morris, 1986). Regardless of the name selected, the point remains that structured knowledge enables inference capabilities, assists in the elaboration of new

information, and enhances retrieval. It also provides potential links between stored knowledge and incoming information, which facilitates learning, problem solving, and action (Glaser & Bassok, 1989). Research has demonstrated that knowledge structures are an important outcome of training that can facilitate the adaptability of training to more complex task contexts for individuals (Kozlowski et al., 1995). A similar impact for knowledge structures may be found in the team training context.

When patterns of interactions occur repeatedly in response to specific task stimuli, members are likely to develop knowledge structures relevant to team interactions. These knowledge structures will have strong effects on team process and performance. As Zalesny et al. (1995) point out, "over time, members will develop, retain in memory, and use as a guide for their responses behavioral, event, and person response sequences that are appropriate for specific situations (Gioia & Poole, 1984; Lord & Kernan, 1987)" (p. 97). Members of effective teams possess a number of different knowledge structures, including those relevant to equipment, the task, and the team. Knowledge structures enable members to generate predictions and expectations about their teammates' roles, task demands, and the equipment used to perform the task (Cannon-Bowers, Salas, & Converse, 1993; Rentsch et al., 1994; Salas & Cannon-Bowers, 1997). Coordination of tasks among members is facilitated by the sharing of knowledge and skills. To the extent that team members have the same appropriate cognitive or mental representation regarding the environment, the simultaneous or sequential coordination of tasks is made easier (Kanki & Palmer, 1993).

Emerging theory (Cannon-Bowers, Salas, & Converse, 1993; Klimoski & Mohammed, 1994; Kozlowski, Gully, McHugh et al., 1996; Rentsch & Hall, 1994) and

research (Jenkins & Rentsch, 1995; Kleinman & Serfaty, 1989; Minionis, Zaccaro, & Perez, 1995) suggest that some components of knowledge structures must be shared across team members to ensure effective team performance. For example, team members must share knowledge of how members' roles interact, how members are related to one another through the task, which information sources are important, and appropriate communication channels and patterns of information flow. Team members must also know when to monitor the behavior of others, when to step in and help a fellow member who is overloaded, and when to change his or her behavior in response to the needs of the team (Cannon-Bowers et al., 1993).

In sum, declarative knowledge about individual tasks, the team, and team-related activities must be acquired in order to facilitate communication, cooperation, and coordination. Some of the information necessary for team performance includes knowledge of member roles and basic task activities, efficient methods of communication, effective cooperation skills, and appropriate timing and sequencing of task activities that facilitate coordination. This knowledge must also be compiled and organized for rapid application to emerging task demands. Additionally, team knowledge must be structured in a similar fashion across team members to provide coherence in member actions and to reduce the amount of processing and monitoring required during task performance (Kozlowski, Gully, Salas et al., 1996).

Affective/Attitudinal. Affective and attitudinal outcomes of training have a clear link with the long-term viability of a team (Hackman, 1987; Sundstrom et al., 1990). Team members with low commitment and negative affect toward the team will withdraw from the team and its task, ultimately compromising the ability of the team to effectively work

together. Conversely, members who have high commitment and positive affect toward the team may create synergistic loops that build on themselves leading to higher performance than would be predicted by the abilities of the individual members (Hackman, 1987; Lindsley et al., 1995).

Individual affective/attitudinal outcomes include, but are not limited to, satisfaction with a task or role, low frustration, and positive commitment to the team. These individual level variables can influence withdrawal behaviors. Withdrawal behaviors are likely to disrupt the team and reduce team effectiveness. Research has demonstrated that satisfaction and commitment are negatively related to withdrawal behaviors like absenteeism and intentions to leave (Hulin, 1991; Muchinsky & Tuttle, 1979; Smith, 1977; Steers, 1977).

Satisfaction and commitment are necessary but not sufficient for team effectiveness. A member might be satisfied with his or her task because rewards are being received for high team performance in spite of the fact that this particular member may not be contributing to the output of the team. Similarly, an individual might be committed to one's task, yet not feel committed to the team as a unit. It is important for members to maintain an orientation to the team as a unit in addition to having positive affective reactions to his or her task, role, outcomes, and position in the team.

Research suggests attitudinal or affective variables are important to effectiveness at higher levels than at the individual level (George, 1990; Ostroff, 1992). Similarly, some theorists have suggested that attitudinal or affective variables regarding the team are important types of team competencies (Cannon-Bowers et al., 1995). Thus, attitudinal and affective variables are important outcomes of team training. Attitudinal or affective

outcomes in team training include cohesion, positive team orientation, and team-efficacy (Cannon-Bowers et al., 1995). Gregorich, Helmreich, and Wilhelm (1990) suggest attitudes toward teamwork skills affect crew processes and performance outcomes. Positive attitudes toward teamwork skills will facilitate the application of these skills, while negative attitudes will inhibit their application.

Cohesion is another important attitudinal/affective outcome of training.

Researchers have noted similarities between commitment and cohesion (Bettenhausen, 1991; Gully, Whitney, & Devine, 1993). Commitment refers to an individual's identification with and attachment to the team's goals or tasks, while cohesion refers to a task-related and social bond among members of a team. Thus, cohesion is the team level analog of commitment, which is at the individual level of analysis (Bettenhausen, 1991). Gully, Whitney, and Devine (1995) found a positive relationship between cohesion and performance for tasks involving high levels of interdependence. Brawley, Carron, and Widmeyer (1988) found a positive relationship between cohesion and resistance of teams to disruptive forces. It should be noted, however, that the positive effect of cohesion on team effectiveness is expected when team norms for performance and team drive are positive and high (Guzzo & Shea, 1992; Stogdill, 1972).

Team-efficacy (TEFF) is an affective/attitudinal outcome of training that may serve functions similar to self-efficacy (SEFF) (Cannon-Bowers et al., 1995; Kozlowski, Gully, Salas et al., 1996). TEFF refers to perceptions regarding the task specific competence of the team as a unit. Although the empirical evidence is sparse, one might surmise that TEFF would influence the application of team-related skills in contexts requiring

generalization of training, provide resilience in the face of challenging demands placed upon the team, and encourage the maintenance of an orientation toward the team as a unit.

Affective and attitudinal outcomes of training at the individual and team level appear to be critical for the adaptation and generalization of training to new task environments and for the long-term viability of a team. It is not enough that individuals are oriented toward their individual tasks and outcomes. Shared team orientations toward teamwork, high levels of cohesion, positively oriented goals for team performance, and high levels of TEFF are all important for team effectiveness.

Review. Thus far we have explored the importance of teamwork and training for team performance. Outcomes important for the adaptation of training to different contexts at the individual level of analysis were identified. These include cognitive, skill-based, and affective/attitudinal variables. Self-regulatory processes involving goals, feedback, and SEFF were discussed as sources of influence on training outcomes in an individual training context. Levels of analysis were then discussed as a conceptual foundation for understanding how cognitive, skill-based, and affective/attitudinal variables might differ in a team training context. Each of these training outcomes were reviewed, with discussion of how the content differs from individual training in a team training context.

The primary difference between outcomes and self-regulatory processes for individuals trained in isolation versus outcomes and self-regulatory processes for members trained in a team environment is that multiple levels, or focal units, are possible. In the individual training context, processes and cognitions relevant to a team are limited or nonexistent, and the collective influence of the team environment does not exist. In contrast, members in a team context can pursue individual knowledge and skills or team

knowledge and skills, both of which are important for team performance. Task strategies and skills developed to optimize individual performance may or may not be consistent with those required to optimize team performance. Additionally, the focal unit of cognitions and affect may vary in the team context. Members may be satisfied with their individual roles, yet they may be dissatisfied with how roles are structured across members in the team. Members can believe that they are high in individual task competence, but they can still believe that the team is low in competence as a unit. Thus, characteristics of the collective environment create complexities for the role of self-regulatory processes for the development of individual and team outcomes of training.

Evidence for the shift in content of training outcomes for team training was presented. Skill-based outcomes of team training include individual skills as well as team interaction skills like communication, cooperation, and coordination. Cognitive outcomes of team training include declarative knowledge regarding individual tasks as well as declarative knowledge regarding roles of other team members, basic aspects of teamwork, and team task characteristics. Another cognitive outcome of team training is the development of knowledge structures that enable the rapid application of knowledge and skills to a particular set of task stimuli. These structures must be appropriate to the task and internally coherent at the individual level, and certain components of them must be similar or shared across members at the team level. Affective/attitudinal outcomes of team training include individual commitment, satisfaction, and SEFF, as well as team unit cohesion, team orientation, and TEFF.

A recurrent theme throughout the discussion has been that although cognitive, skill-based, and affective/attitudinal variables are important at the team level, it is the

individual members in the team that learn, behave, and feel in response to the stimuli presented in the training context. Little is known, however, about the processes leading to the development of these outcomes. Self-regulatory processes are a likely explanatory mechanism leading to the development of team training outcomes. The next section will review research findings involving key aspects of self-regulatory processes, including goals, feedback, and efficacy. Individual findings will be discussed briefly, followed by a discussion of findings relevant to team or group level contexts. Boundaries or limitations of the findings are noted, providing the background for the integrative model presented.

Research on Components of Self-Regulatory Systems

Goals. A goal is the object or outcome for which one is aiming, as well as the standard by which one evaluates one's performance (Bandura, 1991; Locke & Latham, 1990; Latham & Locke, 1991). Goals affect effort and persistence, and the development of plans and task strategies. The evidence supporting the influence of goal-setting is strong and consistent (Locke & Latham, 1990). Goal-setting has been shown to influence performance in a variety of situations using different tasks and samples, including production workers (Dachler & Mobley, 1973), engineers and scientists (Latham, Mitchell, & Dossett, 1978), and loggers (Latham & Kinne, 1974). Guzzo, Jette, and Katzell (1985) found the average effect size of goal-setting as an intervention to be .75.

Several key characteristics of goals have been found to be important for effective task performance. First, more difficult goals lead to higher performance on most tasks. Goals can be easy, moderate, difficult, or impossible. Given adequate ability and commitment to a goal, the higher the goal, the higher the performance (Locke & Latham, 1990). Second, the more specific the goal content, the higher the performance. Goals can

be vague and challenging, like "do your very best" or they can be specific and challenging, like "score 98 out of 100 on the next test". A large number of research studies have found that specific challenging goals lead to higher performance, but this is moderated to some degree by the complexity of the task and a person's task experience (Kanfer & Ackerman, 1989; Wood et al., 1987).

Goals exist in a hierarchy such that higher level goals affect the setting of lower level goals, or the strategy used to attain the higher level goals (Campion & Lord, 1982; Carver & Scheier, 1981; Lord & Kernan, 1987). For example, Earley and Perry (1987) found that people given specific challenging goals on brainstorming tasks did more task planning and developed different types of plans than those without goals. Similarly, Earley, Wojnarowski, and Prest (1987) found associations between goals and the amount of task planning. Such plans and strategies become increasingly learned, proceduralized, and compiled over time.

Most research on goals has been done at the micro, or individual level; little research has been done on group or team goal-setting (Austin & Bobko, 1985; O'Leary et al., 1994; Smith, Locke & Barry, 1990). More recent research is beginning to examine this issue (Klein & Mulvey, 1995; Matsui et al., 1987; Mitchell & Silver, 1990; Saavedra et al., 1993; Weingart, 1992; Weingart & Weldon, 1991; Weldon & Weingart, 1993). The goal mechanisms discussed at the individual level may also apply to goals at a collective level (Locke & Latham, 1990). Several studies show that collective goals can improve team performance (Locke & Latham, 1990; Mitchell & Silver, 1990; Pritchard et al., 1988; Weingart, 1992; Weldon & Weingart, 1988, 1993). Furthermore, research suggests that specific challenging group performance goals lead to higher performance than groups

without goals, especially when feedback is available (Matsui et al., 1987; Pritchard et al., 1988; Zander, 1971). Smith et al. (1990) conducted a study involving 296 business majors organized into 16 simulated organizations. They found the setting of specific, challenging goals to be positively related to performance at the macro level.

It is not clear, however, that research on goal-setting at the individual level will be generalizable to the team level because additional complexities may exist at levels higher than the individual (Ilgen et al., 1987; Klein & Mulvey, 1995). For example, collective variables like task/role structure, social loafing, social facilitation, group or team size, social comparison processes, cohesion, and social cognition may influence the effects of goal-setting on performance. Additionally, variables mediating the goal effect in collective environments may be different than those in individual environments.

Goals help teams to define member tasks, coordinate their actions, and develop efficient work procedures (Klein & Mulvey, 1995; Zander, 1968, 1971). One mechanism mediating the team goal effect may be planning or strategy development (Weingart, 1992; Weldon & Weingart, 1988, 1993; Weldon et al., 1991). Orasanu (1990, 1993) found definition of objectives and formulation of action plans distinguished effective from ineffective aircrews. Similarly, Smith et al. (1990) found the setting of specific, challenging goals to be positively related to planning.

The team goal effect may also be mediated by extrarole and cooperative behaviors (Mitchell & Silver, 1990; Weldon & Weingart, 1988). As defined by Katz and Kahn (1978), extrarole behaviors are behaviors falling outside prescribed roles that are performed to facilitate the accomplishment of collective goals. These include actions that facilitate the performance of others or that facilitate interaction among members (Weldon

et al., 1991). Similarly, Earley and Northcraft (1989) argue that goals can be used to reduce conflict on interdependent tasks. Larson and Schaumann (1990; cited in Latham & Locke, 1991) found that specific, hard goals led to better team performance than do your best goals on a cooperative task, as long as the team cooperated with one another when appropriate. Interestingly, Mitchell and Silver (1990) found that cooperative behaviors mediated the influence of team goals on performance outcomes although Weldon et al. (1991) did not find a similar effect. Deutsch (1949) suggested cooperative goals will promote cooperative behavior, whereas a competitive social situation will stimulate competitive behavior.

Collective goals may have a progressive effect on cooperation. It is possible that a team goal does not automatically result in the activation of cognitions that focus on cooperative strategies. The team goal may trigger the identification of team performance outcomes as important, but not to the point where individuals immediately choose strategies that are cooperative (Crown & Spiller, under review). Thus, a collective goal effect on cooperation and other team related processes may emerge as individuals interact with other members.

Team goals (TMGLS) can also improve performance through motivation or effort. Matsui et al. (1987) found that collective goals motivated performance above and beyond that of individual goals (INDGLS) on an additive task. In fact, group goals had significant effects on performance even after the effects of ability, individual goals, and goal acceptance were removed. TMGLS motivate members to improve the performance of their own personal assignments by working harder and by improving individual performance strategies. Collective goals also motivate members to work together and to

build efficacy (Weingart & Weldon, 1991). Mitchell and Silver (1990) found INDGLS and TMGLS together augment team performance, at least partly through motivation and development of cooperative strategies. INDGLS alone led to competitive strategies that inhibit team performance.

The efficacy of goals for improving task performance in collective contexts is due to both task and goal characteristics (Crown, 1993; Crown & Rosse, 1995). Research suggests INDGLS may improve performance in group contexts (Kim & Hamner, 1976; Matsui et al., 1987), while others have reported less positive results for INDGLS (Mitchell & Silver, 1990; Saavedra et al., 1993). An important explanation may be the nature of the task (Crown & Rosse, 1995; Saavedra et al., 1993). For tasks requiring greater amounts of interdependence, TMGLS lead to higher performance than INDGLS (Saavedra et al., 1993).

Individuals in collective settings can have goals for the self and goals for the team, but the influence of such multiple goals has rarely been examined (Ilgen et al., 1987; Klein & Mulvey, 1995; Locke & Latham, 1990). Multiple goal environments require significant information processing demands beyond the capabilities of many individuals. Thus, individuals will often focus on a single goal or a limited number of goals. Goals direct attention and activity toward actions which are relevant to it at the expense of actions which are not goal-relevant (Bavelas & Lee, 1978; Latham & Locke, 1991; Schmidt, Kleinbeck, & Brockman, 1984; Staw & Boettger, 1990; Wright, George, Farnsworth, & McMahan, 1993).

This makes the focal level of a goal an important attribute of the goal itself (Crown, 1993). Goals may be set at the individual level or at the level of the team. They will then

influence attentional focus, strategy development, planning, learning, and skill acquisition. INDGLS will influence proximal motivational processes, leading to specific cognitive and behavioral outcomes important for individual task performance (Crown, 1993; Crown & Rosse, 1995). When tasks are interdependent, behaviors that lead to increased individual performance may or may not lead to increases in team performance (Crown, 1993; Ilgen et al., 1987; Mitchell & Silver, 1990). TMGLS are important for stimulating individual members to work toward a common objective. Therefore, when tasks are interdependent, members of a team will be most effective when both INDGLS and TMGLS are provided (Mitchell & Silver, 1990).

In sum, TMGLS influence team performance such that specific difficult goals lead to higher performance than general or easy goals, or no goals at all. The effect of TMGLS on team performance appears to occur through a number of mediating variables, including cooperation, coordination, effort, strategy development and adjustments, and planning (Matsui et al., 1987; Mitchell & Silver, 1990; Weldon et al., 1991). The effect of collective goals may depend on interaction demands of the task and on length of experience with the task (Ilgen et al., 1987; Saavedra et al., 1993).

Although emerging research evidence suggests collective goals are effective for increasing collective performance, there are some limitations to previous research. First, little is known about the social, psychological, and specific behavior processes responsible for the effect of collective goals on collective performance (Weldon et al., 1991). Planning, strategy, and motivation appear to be important, but less is known about the factors influencing the development of such variables.

Second, most research has been done with groups performing simple tasks (e.g., tinkertoys, word puzzles, stacking blocks), and such tasks are often performed in a limited time period (e.g., 20 minutes, 30 minutes). Thus, most studies have used simple or additive tasks and less is known about how interdependent teams performing a complex task with clearly defined roles are influenced by INDGLS and TMGLS.

Third, research tends to focus on the influence of goals on individuals or teams, but there is little or no theory linking the two levels (see Crown, 1993; Crown & Rosse, 1995, for exceptions). The manipulated variable is usually the presence or absence of goals or the difficulty and specificity of goals. Few studies have investigated the dynamic interplay between the influences of INDGLS and TMGLS on individuals in a collective environment (see Matsui et al., 1987; and Mitchell & Silver, 1990 for exceptions).

In general, the influence of multiple goals on performance has received less attention than single goals (Kernan & Lord, 1990; Locke & Latham, 1990), and few studies investigate effects of dual goals when performance dimensions are interrelated. Recent attention has focused on the notion that multiple goals may negatively affect some dimensions of performance (Erez, 1990; Gilliland & Landis, 1992; Locke, Smith, Erez, Chah, & Schaffer, 1994), but these studies tend to focus on quantity versus quality goals, or safety versus production goals. It is not clear how INDGLS and TMGLS may positively or negatively influence individual and team performance on an interdependent task (Klein & Mulvey, 1995). Emerging research suggests that characteristics and interactions of INDGLS and TMGLS play an important role in determining collective performance (Crown, 1993; Crown & Rosse, 1995). However, virtually nothing is known

about how the interplay between INDGLS and TMGLS affects learning and application of trained skills in highly interdependent teams.

Fourth, little is known about the influence of consensus or agreement on collective goals. Bourgeois (1980) and Grinyer and Norburn (1975) examined the relationship between goal agreement among organizational members and organizational effectiveness and found no effect. However, it is possible that the influence of goal consensus depends on the level of the goal. A literature search turned up no empirical studies examining this potential moderating effect.

Finally, and perhaps most importantly, most research in collective contexts has been done using assigned goals (Hinsz, 1995a; O'Leary et al., 1994). Little is known about the determinants of goal-setting in a collective context. Weldon et al., (1991) found that group members set goals for themselves that were different from the assigned goals. Weldon and colleagues argue that the role of self-set goals for collective goal effects should be studied in future research. Their data suggest that self-set goals influence group process and performance, but they could not test for such effects within their study (Weldon et al., 1991). Research by Hinsz (1991, 1992, 1995a, 1995b) is beginning to examine issues related to self-set goals in groups, but these studies involve additive or noninterdependent tasks that can be performed independently by individuals in groups.

Self-set goals are an important component of the self-regulatory process. As noted, people can respond to feedback by lowering goals in response to negative discrepancies or by engaging in behaviors to reduce them. They can also proactively set higher goals, even when discrepancies are positive or don't exist. From a self-regulatory perspective, goals are derived from self-evaluative reactions to one's performance and judgments of SEFF.

These goals then influence actions and cognitions, leading to subsequent self-monitoring and self-reactions (Cervone, Jiwani, & Wood, 1991). Self-set goals have been found to produce more positive affective reactions, including satisfaction with the goal, satisfaction with performance, and commitment to the goal (Hinsz, 1995a; Vanderslice, Rice, & Julian, 1987). In multiple goal environments, the antecedents and consequences of self-set goals are likely to be important issues, but little research exists on these topics.

The review of research on goals at the individual and team levels suggest several issues requiring consideration. First, goals appear to influence both individual and team performance, at least partially through attentional focus, effort, planning, and strategy. Less evidence exists regarding how goals influence learning and skill acquisition, although research suggests characteristics of goals may influence these processes (Dweck, 1986; Kanfer & Ackerman, 1989). Second, research on goals typically involves either the individual or team level. Less is known about how the focal level of goals influence activities and learning of individuals in collective environments. Emerging research suggests such goal attributes may have strong effects on collective performance (Crown & Rosse, 1995; Matsui et al., 1987; Mitchell & Silver, 1990; Saavedra et al., 1993). Third, research has rarely examined antecedents and consequences of self-set goals in collective contexts. Self-setting of goals or standards is an important component of the regulatory process, potentially influencing outcomes of training. Although mounting evidence suggests goals are important in collective settings, less is known about from where such goals come and how they influence learning and skill acquisition during training. As Ilgen et al. (1987) point out, there is a lack of a "systematic series of studies or an overarching

model for looking at goals in team settings." In sum, it is clear that goals are important determinants of human cognitions, behavior, and affect (Locke & Latham, 1990).

Efficacy. Self-efficacy (SEFF) influences the choice of goals, the level of goals set, and how committed people remain in the pursuit of goals (Bandura, 1986, 1991; Locke & Latham, 1990; Wood & Bandura, 1989). SEFF is defined as a comprehensive summary judgment involving a person's beliefs in his or her capabilities to mobilize the motivation, cognitive resources, and courses of action needed to perform a specific task (Bandura, 1986; Gist & Mitchell, 1992; Wood & Bandura, 1989).

SEFF influences self-monitoring and cognitive processing of various aspects of one's performance and the outcomes that result from them (Bandura, 1991). SEFF has been associated with performance in work-related contexts, including life insurance sales (Barling & Beattie, 1983), faculty research productivity (Taylor, Locke, Lee, & Gist, 1984), coping with difficult career-related tasks (Stumpf, Brief, & Hartman, 1987), socialization (Smith & Kozlowski, 1994), and adaptability to new technology (Hill, Smith, & Mann, 1987).

SEFF exerts important influences on learning and training outcomes. SEFF has been found to influence learning outcomes such that higher levels of SEFF lead to more positive outcomes (Brown, Lent, & Larkin, 1989; Schunk, 1994; Wood & Locke, 1987). A meta-analysis suggests that the positive effects of SEFF on academic outcomes are particularly facilitative for underachieving students (Multon, Brown, & Lent, 1991; Borkowski & Thorpe, 1994).

SEFF has also been found to be related to training outcomes. SEFF is related to training performance on an innovative problem-solving task (Gist, 1989), the acquisition

of computer software skills (Gist, Schwoerer, & Rosen, 1989; Martocchio & Webster, 1992), complex interpersonal skills (Gist, Stevens, & Bavetta, 1991), and performance improvement in a university bowling class (Mathieu, Martineau, & Tannenbaum, 1993). Ford, Quiñones, Sego, and Sorra (1992) found that individuals higher in SEFF performed more trained tasks several months after training. Quinones (1995) found pre-training SEFF and fairness perceptions influenced motivation to learn, which in turn, influenced performance.

Research on socialization has found that SEFF influences newcomer learning and adaptation to new environments. Saks (1995) found pre- and post-training SEFF to be related to job performance and the ability of newcomers to cope with their jobs. Smith and Kozlowski (1994) found that SEFF interacted with job analyzability to affect learning strategies of newcomers, with those higher in SEFF relying more on self-oriented strategies and experimentation to learn jobs. Similarly, Major and Kozlowski (1991) found that high SEFF newcomers were more likely to rely on their own strategies for learning rather than coworker information. SEFF has also been found to be a better predictor of subsequent performance than past behavior (Gist, Stevens, & Bavetta, 1991), particularly when people are facing tasks that have increased in difficulty, complexity, or challenge (Bandura, 1977; Bandura, 1982; Kozlowski et al., 1995; Smith et al., 1995; Wood & Bandura, 1989).

There are four primary informational cues which can influence SEFF (Bandura, 1977, 1982, 1986; Gist, 1987). The first is enactive mastery, which is defined as repeated performance accomplishments. The second is vicarious experience, which refers to observation or modeling of behaviors. The third is verbal persuasion, which is defined as

verbal behaviors which are directed toward convincing a person of his or her capability of performing a task effectively. The fourth is an individual's perception of his or her own physiological state. For example, individuals who are high in arousal may interpret the arousal as anxiety or fear and may feel vulnerable to failure.

Research has shown that SEFF has an impact on goal-setting and goal commitment. The goals people set at the beginning of an endeavor are likely to change, depending on current progress and the factors influencing the perceived likelihood of future success (Campion & Lord, 1982; H. J. Klein, 1989). Goal commitment refers to an attachment or determination to reach a particular goal (Hollenbeck & Klein, 1987; Locke, Latham, & Erez, 1988). Individuals strong in SEFF set more challenging goals and remain more committed to them over time (Locke, Frederick, Lee, & Bobko, 1984; Locke & Latham, 1990; Wood et al., 1990). Thus, SEFF will influence how goals change as people interact with a task. Goal commitment and goal-setting, in turn, have been shown to be related to intensity of effort, attentional direction, persistence, strategy development, and subsequent performance (Locke & Latham, 1990). The higher the efficacy, the more challenging the standards people set for themselves, and the higher their resulting motivation, learning, and performance (Schunk, 1994).

Bandura (1991) noted that self-regulatory theories which are based only on the negative feedback loop predict that if performance matches an internal standard, the person does nothing, and such a system leads nowhere. Bandura suggests that people can proactively adopt new goals. As Bandura stated, "negative feedback may help to keep people going on a preset course, but from time to time they must transcend the feedback loop to initiate new challenging courses for themselves" (Bandura, 1991, p. 259). Self-

regulation relies on both discrepancy production and discrepancy reduction and it requires proactive as well as reactive control. From this perspective, SEFF is a critical component of the self-regulatory process. It influences how people respond to current goals and feedback and how they will proactively adopt new goals (Bandura, 1991).

In sum, individual research suggests that SEFF affects goal-setting and goal commitment, which in turn, affect learning, skill acquisition, and performance outcomes through individual regulatory processes. Information regarding these outcomes feed back to affect SEFF and subsequent goal-setting (Bandura, 1991; Locke & Latham, 1990; Wood & Bandura, 1989). This simple model can be used to explain pygmalion effects, self-fulfilling prophecies, learned helplessness, and a variety of other cyclical performance effects. As an example, Locke and Latham (1990) describe a high performance cycle which consists of a synergistic loop in which high SEFF leads to high motivation and performance, which increases SEFF even further. The increases in SEFF then lead to higher goals, motivation and subsequent performance. The converse can happen as well; low SEFF can lead to lower goals, motivation and performance, which can lead to further decrements in SEFF (Lindsley et al., 1995).

The relationship between SEFF, goal-setting, goal commitment, learning, and performance may also be useful for describing self-regulatory processes oriented toward the team as a unit. It should be noted, however, that in the team context there are at least two types of competency beliefs. The first is SEFF regarding the individual's task or role within the team. The second is a sense of collective competence regarding the ability of members to work together to meet situational demands and achieve desired outcomes. In other words, the focal unit of the efficacy perceptions can refer to individuals or to the

team as a unit. Additionally, efficacy perceptions can be held by individual members or they can be shared across members of the team.

A number of researchers have theorized that collective efficacy and related constructs may be important determinants of collective performance (Bandura, 1982, 1986; Cannon-Bowers et al., 1995; Gist & Mitchell, 1992; Guzzo et al., 1993; Lindsley et al., 1995; Shea & Guzzo, 1987b; Zaccaro, Blair, Peterson, & Zazanis, 1995; Zaccaro, Zazanis, Diana, & Greathouse, 1994). As noted by Bandura (1982, p. 143), "perceived collective efficacy will influence what people choose to do as a group, how much effort they put into it, and their staying power when group efforts fail to produce results."

It is hypothesized, based on individual level findings, that TEFF perceptions will affect goal-setting and goal commitment, which in turn, will affect team training outcomes and adaptability of team training. The focus of efficacy perceptions in the current study revolves around individual perceptions regarding the efficacy of the team as a unit. Thus, the term personal team-efficacy (PTEFF) will be used to distinguish an individual level perception regarding the team from a collective or shared perception regarding the team.

PTEFF is defined as a comprehensive summary judgment involving an individual's beliefs in the team's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to perform a specific task (adapted from definitions of SEFF provided by Bandura, 1986; Gist & Mitchell, 1992; Wood & Bandura, 1989). The construct of PTEFF is similar to various other constructs like group aspiration level (Zander & Medow, 1963), collective efficacy (Bandura, 1982; Zaccaro et al., 1995); group potency (Guzzo, Yost, Campbell, & Shea, 1993; Shea & Guzzo, 1987a, 1987b), collective competence or control (Zaccaro, Zazanis, & Gilbert, 1993), and morale (Zenter,

1951). Common to all of the constructs noted above is that perceptions of the capability of a collective to achieve an outcome have important effects on member motivation, learning, and performance. However, PTEFF is distinguishable from these other constructs in a number of ways.

First, PTEFF is a construct defined for a specific type of collective environment: teams. In contrast, the above constructs do not speak to teams per se. Group potency and group aspiration level refer to work groups, but as noted earlier, contextual aspects of a group may be different in important ways from that of a team. Collective efficacy, morale, and collective competence can refer to perceptions regarding groups, organizations, or even nations (Bandura, 1982, 1986; Shamir, 1990; Zaccaro et al., 1995). In other words, these constructs can refer to any system larger than an individual. Such constructs may have meaning for researchers looking at multiple levels, but it may lead to confusion, overgeneralization, and misinterpretation when applied to teams.

Second, PTEFF focuses on task specific perceptions of capability regarding the team as a unit. This is consistent with the literature on SEFF. In contrast, group potency, morale, and collective competence refer to generalized beliefs about the capabilities of the team as a unit. Although there are many parallels between the construct of group potency and TEFF, a critical point of departure is that group potency refers to "...a more generalized belief. A group's sense of potency is...meant to refer to a shared belief about general effectiveness across multiple tasks encountered by groups in complex environments" (Guzzo et al., 1993, p. 90). Similarly, collective competence or control also refers to generalized perceptions of competence. The measurement scale contains

questions like "My group has the ability and resources to handle any kind of task or demand we may confront" (emphasis added).

Third, PTEFF can be distinguished from other related constructs because it refers to individual perceptions regarding the team as a unit. In its inception, it was not clear whether collective efficacy referred to individual perceptions of the collective or to shared perceptions among members about the collective. Some researchers have focused on collective efficacy as individual perceptions regarding a collective unit (Cannon-Bowers et al., 1995; Riggs & Knight, 1994; Shamir, 1990). Others have defined collective efficacy using shared perceptions as the construct of interest (Lindsley et al., 1995; Zaccaro et al., 1994). Group potency refers to perceptions shared by the group. Group potency is defined as "the collective belief of a group that it can be effective" (Shea & Guzzo, 1987b, p. 335, emphasis added). Thus, group potency is clearly a group level construct because it refers to a collective belief shared by group members. Group aspiration level is also a shared construct. It is the result of group members unanimously agreeing on a specific performance target (Zander & Medow, 1963). PTEFF can also be distinguished from the construct of collective control. This construct refers to a "belief shared among all group members that collectively they can allocate, coordinate, and integrate member resources to attain group goals" (Zaccaro et al., 1993, emphasis added).

In sum, although PTEFF is similar to various related constructs, it can be differentiated on three important dimensions. First, the focal unit of PTEFF refers to the team as a unit. In contrast, the focal units of other constructs may be dyads, groups, teams, organizations, even nations. Second, PTEFF refers to perceptions of task specific capability. In contrast, morale, group potency, and collective competence or control refers

to generalized capabilities. Third, PTEFF refers to individual perceptions, whereas many of the related constructs refer to perceptions shared among members. Each of the other constructs has usefulness for certain research endeavors, depending on the level of theory, focal unit of interest, and methodologies available.

There are, however, some advantages, both conceptual and methodological, to using PTEFF as a construct when studying outcomes of team training. First, it is specific to teams and team level processes. This avoids overgeneralization of findings in other areas of research (e.g. collective efficacy of large groups, organizations, or nations). Second, it provides a strong and clear link to the large literature on SEFF. As such, measurement methods and theory can be directly imported and used to suggest or support future research directions. For example, researchers have rarely measured the magnitude and strength of efficacy perceptions about a collective, even though this is a standard technique in SEFF research (Gist, 1987). Third, PTEFF focuses on individual perceptions about the team as a unit. These perceptions, in turn, can be expected to influence the goals members set, and the skills and knowledge they acquire during training.

PTEFF is not the same as SEFF, which is an individual's perception of his or her ability to fill a given role or complete a specific task. Although SEFF and PTEFF are both individual level constructs, SEFF is oriented toward perceptions of the self while PTEFF is oriented toward perceptions of the team as a unit. PTEFF is likely to be affected by factors unique to the team context such as perceived competence of other team members, team strategy, availability of team resources, team environment, competitiveness or cooperativeness of team members, and team experience.

PTEFF is rooted in perceptions of SEFF (Bandura, 1982), but differences between perceptions of SEFF and PTEFF can occur. For example, an individual may believe that he or she can fulfill his or her role effectively (high in SEFF) but still believe that the team cannot function effectively due to poor coordination skills (low in PTEFF). Conversely, an individual may believe that he or she cannot fulfill his or her role effectively (low in SEFF) but still believe that the team will attain its objectives because all of the other members can help out to ensure that the team performs effectively (high in PTEFF). These are examples where individual perceptions of team-efficacy (PTEFF) can be useful as determinants of individual self-regulation and behavior separate from the effects of SEFF.

The empirical work on TEFF and other related constructs is emerging (Cannon-Bowers et al., 1995; Lindsley et al., 1994; Prussia & Kinicki, 1996; Zaccaro et al., 1994). Initial findings suggest that perceptions of efficacy and other related constructs have important influences on collective activities (Campion, Medsker, & Higgs, 1993; Campion, Papper, & Medsker, 1996; Feltz et al., 1989; Forward & Zander, 1971; Hodges & Carron, 1992; Prussia & Kinicki, 1996; Shea & Guzzo, 1987b; Spink, 1990; Travillian, Baker, & Cannon-Bowers, 1992).

Shea and Guzzo (1987a, 1987b) found groups high in group potency performed better than groups low in group potency. They argue this effect should be particularly strong for tasks requiring interdependence (Shea & Guzzo, 1987b). Campion et al. (1993, 1996) found significant positive associations between group potency and group productivity, employee satisfaction, and managerial ratings of performance. Feltz et al. (1989) found that collective efficacy predicted the performance of hockey teams above individual efficacy perceptions. Performance was defined using variables like margin of

win, game outcome, and scoring percentage. Prussia & Kinicki (1996) found collective efficacy was related to group goals and performance. Lindsley, Mathieu, Heffner, and Brass (1994) found TEFF and performance were reciprocally related to each other over time. Higher efficacy led to higher performance, which led to higher efficacy. Zaccaro et al. (1993) found collective competence was positively related to cohesion at the individual and group level, and Riggs and Knight (1994) found collective efficacy was positively related to satisfaction and commitment. In general, the higher the efficacy, the more positive the collective outcomes. Unfortunately most research has not clarified the mechanisms through which PTEFF affects team outcomes.

Interestingly, almost no work could be identified that describes the antecedents of PTEFF and related constructs (see Guzzo et al., 1993; Prussia & Kinicki, 1996; and Zaccaro et al., 1994 for exceptions). It would seem that the same antecedents for SEFF identified by Bandura (1982, 1986) will apply to PTEFF, but other antecedents may also be important. PTEFF involves more complex cognitions than SEFF because it involves a perception of what the team is like as a unit, the goals and objectives of the team, other team members' knowledge, skills, and abilities, and the effectiveness of the team strategy and role structure for attaining desired outcomes.

Research at the collective level suggests perceptions of efficacy will influence commitment, cohesion, and performance. Extrapolating from individual level research, one can also surmise that PTEFF will influence individual setting of and commitment to TMGLS, thereby influencing individual strategy, learning, and skill acquisition. Little is known about how perceptions of efficacy regarding a collective unit will influence adaptability of team training, although Cannon-Bowers et al. (1995) have identified TEFF

as an important training outcome. Additionally, little is known about the factors that influence perceptions of PTEFF, although past performance clearly has strong influences (Lindsley et al., 1994; Prussia & Kinicki, 1996; Zaccaro et al., 1994).

Although research is beginning to explore antecedents and consequences of TEFF (Lindsley et al., 1995), there are several limitations in our current knowledge. First, research on TEFF and related constructs have occurred at various levels of analysis. This is problematic because results found at one level are not always immediately generalizable to another level of analysis (Klein et al., 1994; Roberts et al., 1978; Rousseau, 1985). Collective efficacy has been discussed as either individual or shared perceptions regarding the collective unit. This can create ambiguities in the interpretation of findings for another level of analysis. Future research must consider how individual perceptions of efficacy about higher level units can influence individual cognitions, behaviors, and performance. Little research has examined efficacy from this perspective.

Second, the research on perceptions of efficacy at levels higher than the individual has rarely considered the process by which efficacy influences outcomes. Efficacy can influence cognitive and motivational processes, including goal-setting, cognition, and learning, but only one study was identified that has explored any part of these relations (Prussia & Kinicki, 1996).

Third, research on perceptions of efficacy has not considered the influence of multiple types of efficacy on self-regulatory processes. Individuals can have SEFF perceptions that may be similar to or different from PTEFF perceptions. These perceptions of efficacy can be congruent with each other, or they may lead to conflicts in orientation toward desired goals. Additionally, research on collective perceptions of efficacy has

rarely examined the incremental contribution of higher level perceptions over that of SEFF. SEFF and individual perceptions of collective efficacy can differentially influence goal-setting, strategy development, learning, and outcomes of training in a team training context. No research has examined this issue.

Finally, little is known about the influence of consensus on efficacy regarding higher level units. It is possible that the effects of perceptions of efficacy will have differential effects on collective outcomes, depending on whether or not they are shared.

The limited amount of research on the differential impact of perceptions of efficacy at different levels is striking, given the important role that SEFF plays in models of individual regulation. PTEFF can be expected to interact with SEFF in a complex interplay to influence the self-setting of INDGLS and TMGLS, the acquisition of individual and team knowledge, and skills, and the adaptation of team training to different environments. Thus, efficacy perceptions are likely to affect self-regulatory processes that provide a transitional link between a loose collection of individuals that eventually become a compatible and coordinated team.

Feedback. Feedback is an important component of the self-regulatory process (Carver & Scheier, 1981; Powers, 1973; Taylor et al., 1984). Feedback is defined as information regarding the results and outcomes of actions or behaviors (Annett, 1969; Cusella, 1987; Taylor et al., 1984). Feedback and goals function together as inputs into the self-regulatory system (Locke & Latham, 1990; Lord & Hanges, 1987; Powers, 1973). Research has demonstrated that feedback is important for the goal-setting to performance relationship to occur (Erez, 1977), in part through its effects on perceptions of discrepancies between current and desired goal states (Campion & Lord, 1982). Without

feedback, discrepancies may not be detected and the self-regulatory process can break down (Taylor et al., 1984). In the absence of goals, feedback can direct attention toward specific aspects of behavior or performance, thus leading to spontaneous goal-setting processes (Taylor et al., 1984).

Feedback can also influence perceptions of efficacy (Prussia & Kinicki, 1996). One of the key influences on perceptions of efficacy is enactive mastery (Bandura, 1977, 1982). Enactive mastery refers to repeated performance accomplishments. Performance accomplishments that consistently meet or exceed expected or desired standards will lead to higher levels of efficacy, while performance accomplishments that are consistently below expected or desired standards will lead to lower levels of efficacy (Bandura, 1986, 1991; Wood & Bandura, 1989). Knowledge of performance accomplishments occurs primarily through the feedback mechanism. Thus, feedback will have strong effects on the development of self- and PTEFF. Performance feedback provides information about prior performance and serves as a basis for determining one's efficacy to perform successfully on subsequent tasks (Bandura, 1986; Martocchio & Webster, 1992). Feedback also provides information regarding the degree to which a standard or goal is being met (Bandura, 1991; Carver & Scheier, 1981, 1982; Latham & Locke, 1991; Powers, 1973; Taylor et al., 1984).

The provision of feedback has been found to lead to higher levels of goals, learning, and performance. The positive effect of feedback on performance is one of the most accepted principles in psychology (Ammons, 1956; Guzzo et al., 1985; Ilgen et al., 1979; Nadler, 1979; Powers, 1973; Taylor et al., 1984). Performance feedback in the work setting has been described as "central to employee training, performance,

motivation, and satisfaction" (Greller & Herold, 1975, p. 244), and a large body of research suggests feedback plays a key role in learning and task performance (e.g., Ammons, 1956; Fedor, 1991; Ilgen et al., 1979; Kopelman, 1986; Taylor et al., 1984). Katzell and Guzzo (1983) found 93% of the studies investigating the relationship between feedback-related interventions and output productivity obtained positive effects. Similar findings were obtained for reduction of withdrawal and disruption behaviors, and improvement in attitudes.

Feedback frequency or availability has been related to productivity (Katzell & Guzzo, 1983), socialization and adjustment (Ashford & Cummings, 1983; Ostroff & Kozlowski, 1992; Smith & Kozlowski, 1994), performance of safe work behaviors (Chhokar & Wallin, 1984; Komaki, Barwick, & Scott, 1978; Komaki, Heinzmann, & Lawson, 1980), and performance of groups (Matsui et al., 1987; Pritchard et al., 1988; Prussia & Kinicki, 1996). Hackman and Oldham (1980) consider feedback a critical component of job characteristics leading to work motivation. Higher levels of feedback are believed to lead to higher levels of motivation. Earley (1988) found that specific feedback is used in the formation of a work plan, and work plans lead to increases in an individual's performance. Earley suggested that specific feedback activates planning by directing an individual's attention to the task at hand. Earley, Northcraft, Lee, and Lituchy (1990) found that feedback directs attention to relevant job behaviors and away from irrelevant or inappropriate ones. Similarly, Ilgen and Moore (1987) found feedback on quality or quantity affected performance on both dimensions. People tended to match their attention and behaviors to the dimensions of performance feedback provided or available.

In spite of the pervasive evidence suggesting positive effects of feedback, some research suggests the relation between feedback and performance does not hold for all tasks (Balcazar, Hopkins, & Suarez, 1986). Jacoby, Mazursky, Troutman, and Kuss (1984) suggest that some forms of feedback may not be as useful on tasks involving complex, cognitively rich decision making. However, they employed outcome feedback that was neither explanatory nor predictive of future performance. It is not surprising that such feedback did not lead to higher performance. Earley et al. (1990) also suggest that outcome feedback may be limited in usefulness on complex tasks because it does not provide specific information regarding how one should adjust behavior. In contrast to this perspective, their findings indicated that specific outcome feedback interacted with specific goals to yield high levels of performance. In addition, Earley et al. (1990) found that outcome feedback interacted with goal-setting to influence self-confidence and effort. Process feedback also interacted with goal-setting to yield high levels of performance, primarily through information search and strategy development.

In spite of the large body of research on the influences of feedback on performance, a limited amount is known about how characteristics of feedback influence psychological processes leading to performance outcomes (Fedor, 1991; Ilgen et al., 1979). Ammons (1956), Vroom (1964), and Ilgen et al. (1979) suggest that feedback can serve at least two functions: motivational and learning. With regard to the motivational function, the positive or negative nature of feedback can serve as a motivating stimulus, increasing the likelihood that certain actions or behaviors will be repeated. Feedback can affect the self-regulatory process by influencing SEFF (Earley et al., 1990) and the setting of personal

goals (Vance & Colella, 1990). Quinones (1995) found feedback regarding training assignment influenced SEFF, motivation to learn, and training outcomes.

Feedback can also perform a learning function by providing one with information about the correctness, accuracy, or adequacy of an individual's past behavior. Ilgen et al. (1979) note that feedback possesses an "information value" that depends on "the incremental increase in knowledge about performance that the feedback provides the recipient" (p. 351). Feedback is an integral part of most training programs (National Research Council, 1991b), in part because feedback can influence training effectiveness by providing information to locate and correct errors in activities or behaviors (Hays & Blaiwes, 1986-87). Feedback also affects cognitive mechanisms by focusing attention and effort toward goal accomplishment (Kernan & Lord, 1988; Locke & Bryan, 1969) and by stimulating thought, planning, and strategy development (Earley, 1988; Earley et al., 1990). The learning and cognitive mechanism of feedback is particularly relevant to skill acquisition and performance on complex tasks (Balzer, Doherty, & O'Conner, 1989).

There are a number of different types and sources of feedback including other people, the task, or the self (Ilgen et al., 1979). Greller and Herold (1975) found that individuals rely most heavily upon the self as a source of feedback, followed by the task, then supervisor, coworkers, and the organization. The current study is primarily focused on the influences of task feedback on the self-regulatory process. The task is chosen as the focal source for three reasons. First, task feedback is available to some degree in many training contexts, and it is likely to have strong influences on training outcomes. For example, Earley (1988) found people who received specific goal referenced feedback from a computer did better than those who received general feedback from the computer or

either type of feedback from supervisors. Unfortunately, we have limited knowledge of how task feedback will influence team training outcomes. Second, self-generated feedback will rely in whole or in part on information available from the task. Third, it is difficult to disentangle self-generated feedback from the self-regulatory process itself, and it is unknown what effect this might have. Thus, task feedback provides an external and somewhat objective form of information. Objective feedback is defined as "information about work behavior or job performance that is relatively factual and incontrovertible" (Kopelman, 1986, p. 120).

Recipients are often thought of as passive recipients of feedback. Presumably recipients receive it as given, accept it, and use it. In contrast, evidence suggests recipients actively process and interpret feedback, and this processing is influenced by various characteristics of feedback like its amount, source, and sign (Fedor, 1991; Ilgen et al., 1979). Research by Ashford and Cummings (1983) and Ostroff and Kozlowski (1992) points to people as being active in the acquisition and interpretation of feedback during newcomer socialization. In spite of the wealth of research conducted on performance feedback, there is still a need to address more fully how feedback is perceived, processed, and reacted to by recipients (Fedor, 1991; Ilgen et al., 1979; Taylor et al., 1984).

One of the key characteristics of feedback that may influence how recipients interpret and respond to feedback in team training contexts is its level of focus (Kozlowski, Gully, McHugh et al., 1996). Research suggests that the more specific the feedback, the more rapid the improvement, and the greater the effects on outcomes (Ammons, 1956; Ilgen et al., 1979; Kopelman, 1986). Little is known about how feedback specificity relates to goal specificity and effects on motivation, learning, and performance

(Earley et al., 1990; Ilgen et al., 1979). This is particularly true with reference to the focal level of goals and feedback (Ilgen et al., 1987).

Most research has been focused on the impact of feedback on individual performance (Barr & Conlon, 1994; Pritchard et al., 1988). It has been noted that one of the most important issues regarding feedback that has received little research attention concerns the appropriate aggregation level presented to group or team members (Barr & Conlon, 1994; Jentsch, Navarro, Braun, & Bowers, 1994; Nadler, 1979; Tindale, Kulik, & Scott, 1991). With regard to aggregation level, Nadler (1979) distinguished between three types of feedback: (1) individual feedback provided to individuals without influence of the group or team context; (2) individual feedback administered to individuals within a group or team context; and (3) group or team feedback administered to members of the entire collective unit. Because the current study is focused on team training, which by definition involves a collective context, only the last two forms of feedback are relevant.

According to Nadler (1979) and Cusella (1987), the influence of team feedback is different from individual feedback. For example, findings by Matsui et al. (1987) indicate that feedback indicating group goals are not reached will continue to motivate individuals even when INDGLS have been met. However, feedback at the team level may be hard for individuals to use and interpret because the information regarding one's performance is confounded or intermixed with the actions of other members (Dyer, 1984; Jentsch et al., 1994). Additionally, the ability of an individual to influence team performance may be constrained by task demands and the behaviors of others (Cusella, 1987; Nadler, 1979). Finally, how the group as a whole deals with feedback information through goal setting

(Zander, 1971) or problem-solving (Maier, 1970) adds another level of analysis that goes beyond the actions of any one individual.

Feedback at the group level has been shown to positively impact group performance or productivity (e.g., Becker, 1978; Erez, 1977; Forward & Zander, 1971; Kim & Hamner, 1976; Nadler, 1979; Nadler, Cammann, & Mirvis, 1980; Pritchard et al., 1988; Zander & Forward, 1968). Group feedback has also been found to increase group pride (Berkowitz & Levy, 1956), task motivation (Berkowitz & Levy, 1956; Nadler, 1979), team accuracy (Rosenberg & Hall, 1958), group attraction and esteem (Frye, 1966), and involvement (Nadler, 1979). However, some research suggests that the confounding nature of team feedback can make it difficult for members to learn from the information, thereby reducing team performance. For example, Jentsch et al. (1994) found team feedback led to the lowest performance on an interdependent task, and Zajonc (1962) found group performance was lowest under confounded feedback conditions.

The influence of individual feedback in collective contexts has also been studied. Such feedback provides information regarding specific individual performance, but in a collective context. Barr and Conlon (1994) found that individual feedback in a group context interacted with group feedback to influence intentions to persist on a task. Individual feedback in collective contexts has been associated with increased individual performance and aggregated group performance (Zajonc, 1962; Zander & Wolfe, 1964). It has also been linked to individual levels of self-esteem (Frye, 1966) and participation rates (Smith, 1972). Stone (1971) found marginally significant effects indicating higher satisfaction and performance with individual as opposed to group feedback. However, research also suggests that individual feedback can lead to a focus on individual strategies,

motivations, and behavior, thereby reducing overall team performance (Matsui et al., 1987; Nadler, 1979). For example, Zander and Wolfe (1964) provided individual feedback, group feedback, and group and individual feedback together. They found that groups receiving group level feedback demonstrated more cooperation, more motivation, and less interpersonal strain than groups receiving individual feedback.

Klaus, Grant, and Glaser (1965) and Marra (1971) found that providing individual and team feedback together lead to more rapid development of individual and team proficiency than did individual or team knowledge of results alone (cited in Dyer, 1984). Similarly, Zander and Wolfe (1964) found the combined group and individual feedback condition showed the greatest improvement in personal scores. Dyer (1984) pointed out that training of teams is most likely to be effective when both individual and team feedback is provided.

Zander and Wolfe (1964) suggested that task characteristics may moderate the relationship between feedback and performance. When a task requires high levels of interdependence, collective feedback may be more effective than individual feedback. Conversely, when individual roles are not interdependent, collective feedback may be less effective than individual feedback. Rosenberg and Hall (1958) found similar evidence for the moderating effects of tasks. They provided individual, collective, and other feedback, and they related these forms of feedback to individual and collective performance. Other feedback was information about the other person's performance. They found individual accuracy was highest in the individual feedback condition and lowest in the other feedback condition. However, the collective feedback condition resulted in better team accuracy than did individual feedback. Glaser and Klaus (1966) and Klaus and Glaser (1970) varied

task structure and found performance decrements for groups receiving collective feedback when performing noninterdependent tasks.

According to Nadler (1979), such findings suggest a contingency model of the effects of team and individual feedback. The most effective form of feedback depends on the desired impact of the feedback and on the nature of the task. Collective feedback is most effective when members are performing an interdependent task with differentiated roles for members. Individual feedback is most effective when performance is the simple sum of individual performances. Findings by Saavedra et al. (1993) support the moderating influence of task characteristics. They found that feedback and goals which were consistent in level of focus with each other and with the interaction demands of the task led to higher levels of performance than when feedback and goals were inconsistent with each other or the demands of the task.

In sum, feedback has important effects on learning and motivation. Feedback is important in team training contexts (Swezey & Salas, 1992), and it is a key tool of team training (Dyer, 1984; Salas & Cannon-Bowers, 1997). Group or team feedback can influence team performance above and beyond that of goal-setting (Pritchard et al., 1988), and individual feedback (Nadler, 1979). However, feedback must indicate whether individual adjustments, team adjustments, or both must be made to improve subsequent performance. Additionally, feedback must be directed at the appropriate level given task demands and desired forms of proficiency in order to be effective (Kozlowski, Gully, McHugh et al., 1996; Nadler, 1979; Salas & Cannon-Bowers, 1997). Team feedback makes it difficult for individuals to discern how they are doing as individuals because it is confounded with the performance of others (Johnston, 1967). However, team feedback

also serves an important orientation function, directing attentional focus of members to collective outcomes and strategies leading to such outcomes. For example, Berkowitz and Levy (1956) found that people receiving group feedback had higher pride and more motivation than those receiving individual feedback.

However, there are limitations in our current knowledge regarding the influence of feedback on team training outcomes. Nadler (1979) noted that little attention has been given to the question of why feedback should affect patterns of group functioning, and under what conditions it will be most effective. Additionally, there are few theories or models to guide one in the use of feedback in team settings. Although there is extensive research on feedback effects on individual behavior, the research on feedback and collective functioning is extremely fragmented and in need of integration (Nadler, 1979). These concerns were echoed by Dyer (1984, p. 303) who stated, "strange as it may seem, few studies have examined the impact of feedback reinforcement within military teams, although many people (e.g., Briggs & Johnston, 1967; Hall & Rizzo, 1975; Wagner et al., 1977) regard it as critical to team performance."

There are a number of reasons why previous research is limited in its applicability to understanding team training, processes, and performance. First, most research has been conducted on individuals in nongroup settings (Barr & Conlon, 1994; Pritchard et al., 1988). Second, although studies have been conducted on feedback effects in groups, they typically only consider the effects of either individual or group level feedback, but not both (e.g., Prussia & Kinicki, 1996). This makes it difficult to understand how different focal levels of feedback interact to influence learning and performance for individuals in teams. Third, most studies have employed tasks with low levels of interdependence. As noted, the

effects of feedback with different focal levels may vary depending on the interaction demands of the task. In teams with clearly defined roles and high levels of interdependence, team feedback may be critical to effective learning, skill acquisition, and performance. Fourth, the influence of feedback at various levels of focus on goal-setting processes is unexplored. Briggs and Johnston (1966) found that teams maximize effort and performance for those aspects of a team task for which they receive feedback. Their research further indicates that teams may neglect other aspects of performance for which they do not receive feedback. Although a literature on the effects of group feedback exists, few studies have included goal-setting (Ilgen et al., 1987). However, it is clear that feedback can influence cognitive, behavioral, and affective variables, which in turn, are likely to influence goal-setting directly or indirectly through efficacy perceptions.

Summary of the Literature Review

Teams are increasingly implemented in a variety of organizational contexts, and the ability to improve team processes and performance is critical for organizational effectiveness. Team training is a commonly used intervention to increase team functioning and performance. Unfortunately, little is known about the critical outcomes of team training that facilitate generalization and adaptability, and less is known about the characteristics of team training environments that lead to such outcomes.

Research suggests cognitive, skill-based and affective variables are important outcomes of individual training that can influence adaptability of training to different environments. Cognitive variables include declarative and structural forms of knowledge. Skill-based variables include compiled and automatized skills. Affective variables include

satisfaction and SEFF. These variables have been shown to have unique effects on performance of tasks requiring generalization and adaptation of training.

Emerging research suggests that self-regulatory processes exert strong influences on training outcomes. Various theories of self-regulation share several key components, including goals, feedback, and perceptions of efficacy. These components interact in a complex hierarchy of goals and feedback loops to influence the acquisition of knowledge and skills. They also influence affective reactions, partially through goal discrepancies. The self-regulatory model is useful for understanding how individuals direct their attentional focus, leading to important training outcomes. Less is known about how self-regulatory processes can lead to team training outcomes.

The levels of analysis perspective suggests that findings at the individual level may not be immediately generalizable to the team level. Variables that exist in higher level social systems like teams may add complexity and impact the self-regulatory process in ways that cannot be considered in individual level theories. For example, the focal level of analysis for learning outcomes, goals, feedback, and efficacy can refer to the individual or the team in a team training context. The primary variables of interest in the current study are adaptability of team training and relevant training outcomes. Little is known about how individual and team level variables interact to influence outcomes important for adaptability of team training, which is a team level variable. Along these same lines, little is known about the outcomes of team training that move teams from a loose collection of individuals to a tightly integrated unit with well-synchronized actions.

It is possible that research on individual training outcomes can be applied to team training contexts. Cognitive, skill-based, and affective variables are likely to be important

for team training outcomes. Cognitive variables include declarative knowledge of individual task characteristics, and task characteristics for the team that span relationships between members. Cognitive outcomes also include coherent knowledge structures for individual members, and some form of sharedness across team members. Skill-based outcomes include individual task proficiencies as well as team-related proficiencies like communication, cooperation, and coordination. Affective/attitudinal outcomes include individual satisfaction and SEFF and team-oriented cohesion and PTEFF.

The key mechanisms of self-regulation leading to training outcomes are expected to apply in the team training context as well. INDGLS have been shown to influence individual attentional focus, planning, strategy development, learning, and performance. Collective goals have also been shown to influence group or team planning, strategy development, and performance. However, less is known about the interplay between individual and collective goals and their effects on learning and performance outcomes. Almost nothing is known about factors affecting self-set goals in a collective context.

Research suggests that SEFF has strong influences on goal commitment and self-setting of goals in individual level studies. SEFF has also been shown to exert considerable effects on learning, motivation, and performance, particularly in the face of difficult circumstances. PTEFF may also serve similar functions. PTEFF may influence goal commitment to collective goals and the setting of such goals. Little research has been conducted on the influence of collective efficacy perceptions, but findings suggest such perceptions may be critical to higher level training and performance outcomes. Almost nothing is known about the interplay between SEFF perceptions and efficacy perceptions of a collective unit and their influences on individual and team outcomes.

Feedback has been shown to influence goal setting, perceptions of efficacy, and performance outcomes at the individual level. Research suggests that recipients actively process and use feedback depending on key characteristics of the feedback. A characteristic of feedback that has important implications for outcomes of team training is its level of focus. Individual or collective feedback may be differentially effective depending on the demands of the task. Feedback directs attentional focus, leading to strategy development and learning. Individual feedback may be most useful for individual or noninterdependent tasks. In teams, where interdependence is high, feedback oriented toward the collective unit may stimulate pursuit of collective outcomes and the development of knowledge, skills, and affect oriented toward such outcomes. Unfortunately, little is known about how individual and team focused feedback interact to influence the self-regulatory process and outcomes of team training.

In conclusion, the review of the literature has suggested outcomes of team training that may be crucial for adaptability of training. Complexities in the application of self-regulatory models derived from individual level research were considered. A review of our current state of knowledge regarding related mechanisms was presented. and several limitations were noted. A number of these limitations will be addressed by an integrative conceptual model which will attempt to tie commonalities among these various literatures together. The model will then be used to derive testable hypotheses which have important implications for training in a team context.

INTEGRATION AND CONCEPTUAL MODEL

Overview

The literature review identifies critical outcomes of team training and the processes influencing their development. Components of the self-regulatory system, including goals, feedback, and efficacy, are important to the development of knowledge, skills, and affect in training environments. Most research to date has investigated how these components influence either individual or team level performance. Less is known about how they interact to affect training outcomes for members being trained in a team context.

Individual self-regulatory processes can enable members of a team to function as a synchronized unit. For this to happen, team members must share and be committed to higher level team goals (TMGLS) yielding compatible individual regulatory processes, including individual goals (INDGLS), culminating in team outcomes. Thus, the focus is on regulatory processes occurring within individuals which have a cumulative effect on the team. Individual members learn and acquire skills relevant to individual and team performance. Additionally, affective outcomes of individual members will combine in some fashion to influence team effectiveness. These cognitive, skill-based, and affective outcomes are the result of regulatory processes unfolding within members of teams during training. Individual members set goals, monitor feedback, and develop efficacy, which in turn, influence outcomes of training for individuals and for the team as a unit. These

training outcomes are crucial for member adaptability to potential changes in the task context.

Figure 5 presents a synthesis of the previous literature on training outcomes, goals, efficacy, and feedback for individuals and teams. It is an elaboration of Figure 4, but the relationships among the constructs and the content of training outcomes are more clearly specified. Additionally, the relationships among training outcomes and performance adaptability are included. Much of the previous literature review focused on individual and team effectiveness, which often implies a static performance component. However, rapidly advancing technology and emerging rates of change in organizations often requires adaptability on the part of individuals and teams to meet the emergent demands of these changes. Training is an oft used mechanism for enabling individuals and teams to face such emergent demands. Thus, the model focuses on how training outcomes lead to the capability to effectively engage in performance adaptation. However, it is not immediately clear whether the literature previously reviewed will effectively apply to the ability of teams to adapt their performance to meet changing task and environmental demands.

Performance adaptability is the degree to which members of a team can effectively apply the knowledge, skills, and attitudes gained in the training environment to a related but different task context requiring generalization of the training outcomes. Thus, performance adaptability is exemplified by a team's ability to perform a task that is higher in complexity or difficulty than the task learned during training. It is also typified by a team's resistance to disruption and viability under adverse task circumstances.

Performance adaptability is a construct which is isomorphic across individual and team

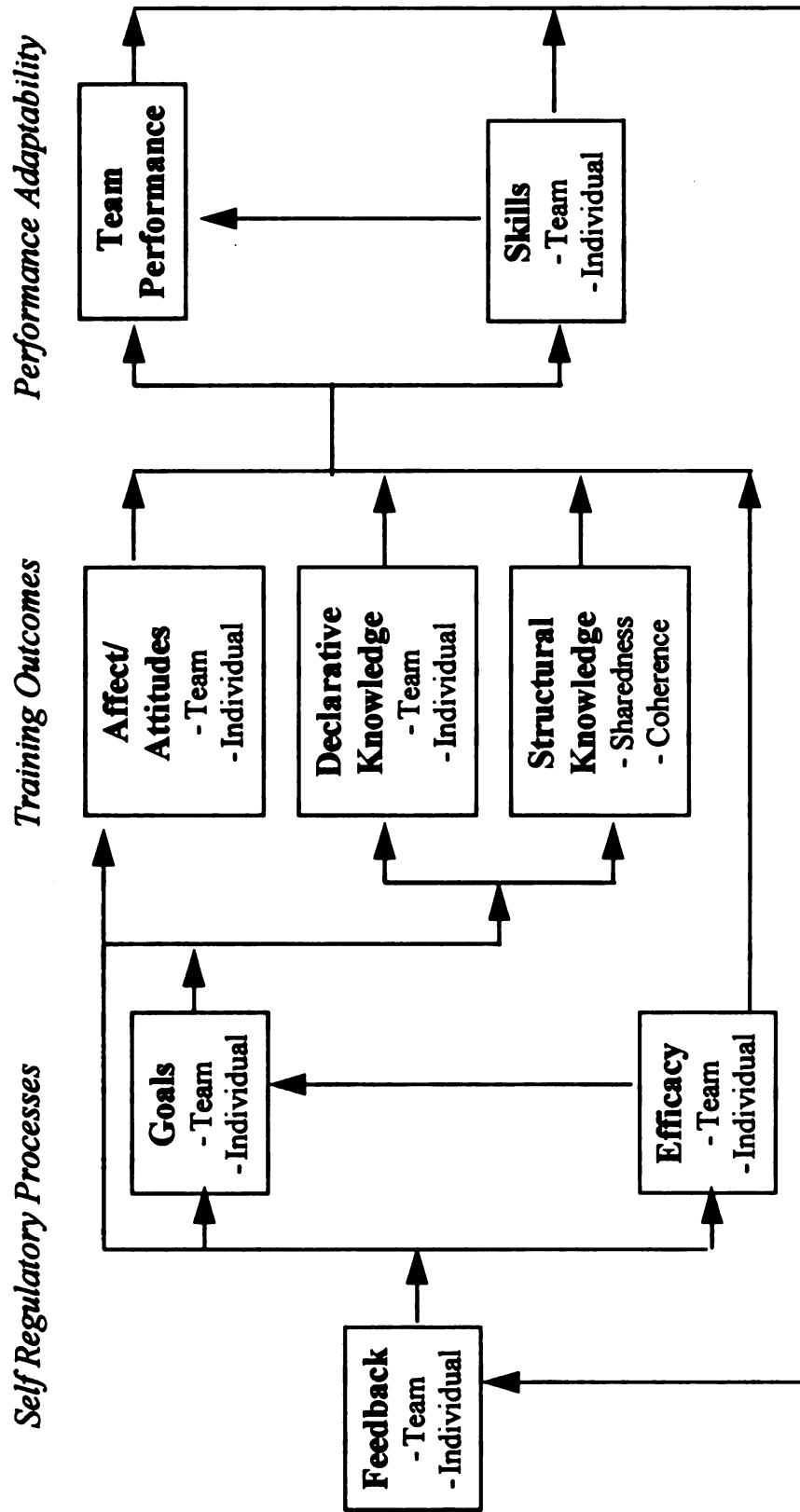


Figure 5. Conceptual Model of the Influences of Individual Self-Regulatory Processes on Team Training Outcomes

levels. In other words, team adaptability is a higher level phenomenon influenced by and encompassing individual member adaptability.

Individual and team skills, declarative knowledge of individual roles and the roles of other team members, and structural knowledge that is coherent and shared across members will influence performance adaptability. These training outcomes, in turn, are developed during training through the influence of the focal level of goals and perceptions of efficacy. The availability of feedback at different focal levels influences efficacy perceptions, goal setting, and training outcomes. Each of these links is discussed in detail.

Influence of Training Outcomes on Performance Adaptability

Previous research suggests that declarative knowledge, structural knowledge, skills, and affect/attitudes are important outcomes of training that can influence performance adaptability at the individual level (Kozlowski et al., 1995; Kraiger et al., 1993; Smith, et al., 1995). Although empirical research has not examined the effects of these outcomes in a team training environment, consistent with research on individual training, each of these training outcomes is expected to exert unique and positive effects on performance adaptability in a team training context.

H1: Training outcomes of declarative knowledge, structural knowledge, skills, and affect/attitudes will exert significant effects on performance adaptability. Each of these outcomes will be positively related to performance adaptability.

As described earlier, training outcomes can refer to individually-oriented knowledge, skills, and affect/attitudes, or they can refer to team-oriented training outcomes. Each of these sets of outcomes can exert different effects on adaptation of training, depending on characteristics of the task. Individual training outcomes refer to

each member's knowledge, competencies, and attitudes related to the performance of tasks that are independent of other members of the team. For example, each member has to understand how to operate equipment and perform basic task functions of his or her role (Nieva et al., 1978). For interdependent tasks, individual training outcomes are the basis for effective team performance (Dyer, 1984; Nieva et al., 1978; Salas et al., 1992).

Individual training outcomes include declarative knowledge regarding individual tasks, coherence of knowledge structures enabling rapid application of learned skills to evolving task demands, individual skills that enable competent individual task performance, and positive affect and attitudes promoting high levels of motivation and resistance to disruptive effects in the task environment. These training outcomes are critical to the performance of any component of the team task. The higher the individual training outcomes, the higher the performance adaptability of the individual members and the team as a whole.

H1a: Individual declarative knowledge, coherence of structural knowledge, individual skills, satisfaction, and self-efficacy will be positively related to performance adaptability.

Individual training outcomes are necessary but not sufficient for team performance adaptability. If any one member of an interdependent team cannot fulfill the demands of a given role, team performance will surely suffer. But presence of individual knowledge, skills, and attitudes by themselves do not guarantee effective team performance. Team oriented training outcomes that influence adaptability include team declarative knowledge, shared knowledge structures, and team oriented affect/attitudes (Cannon-Bowers et al., 1995).

There are a number of different forms of declarative knowledge important in the team context, including knowledge of other members' roles and positions, and the articulation of concepts related to team skills like communication, coordination, and cooperation. Team declarative knowledge is a team-related training outcome at the level of individual members. Research by Cream (1974, Cream et al., 1978) and Baker and colleagues (Baker, 1991; Baker et al., 1992) demonstrates that knowledge of other member roles is related to team process and team performance. Similarly, one would expect that declarative knowledge regarding the nature and importance of communication, coordination, and cooperation would provide the foundation for the development of knowledge structures and skills related to these team competencies. Each of these types of team declarative knowledge are important to the development of higher forms of team knowledge and skills, and adaptability of team training.

In addition to team declarative knowledge, recent theory (Cannon-Bowers et al., 1993; Klimoski & Mohammed, 1994; Kozlowski, Gully, McHugh, et al., 1996; Rentsch & Hall, 1994) and research (Jenkins & Rentsch, 1995; Minionis et al., 1995) suggest that shared knowledge structures are important outcomes of training. As declarative knowledge is acquired, it becomes increasingly organized into networks of linked concepts enabling rapid application to environmental stimuli (Lord & Maher, 1991). Although individual members may develop highly coherent knowledge structures, this alone does not ensure smooth and coordinated performance in the team.

Consider a situation where each member seems to know exactly what needs to be done, but the members share little or no knowledge regarding appropriate timing and content of role behaviors. If knowledge structures regarding role behaviors and task

sequencing are not shared across team members then each member may act rapidly and adeptly as an individual, but each member would also perform tasks in an uncoordinated fashion using strategies incongruent with those of other team members. Boguslaw and Porter (1962) cite an example in which a scope reader on an air defense task performed extremely accurately and quickly. Unfortunately, the scope reader performed so well that other members of the team could not keep up and several targets were missed as a result.

If members of a team share knowledge structures regarding the timing and sequencing of task behaviors, such problems are less likely to occur. The development of shared structures occurs through repeated interactions with a task which enable routines and procedures to become developed (Gersick & Hackman, 1990). Research has demonstrated that members become more similar in perceptions of team behavior as experience or training progresses (Morgan, et al., 1986; Rentsch et al., 1994). The sharedness of knowledge structures is a team level outcome of team training crucial to performance adaptability.

Although individual skills are important for performance adaptability, they are not sufficient to ensure effective team performance. Team skills like communication, cooperation, and coordination are also crucial to team performance adaptability. It is important to recognize that team skills can only be developed if other members of the team engage in team-related activities. Thus, any individual member can attempt to learn team skills, but it requires more than one member to provide opportunities to use such skills in the team training context. Therefore, teams which have multiple members oriented toward practicing team-related skills will have better performance adaptability than will teams that have a single member attempting to practice such skills. Logically, team-related

affective variables like cohesion and personal team-efficacy (PTEFF) should influence orientation and motivation toward engaging in such team-related activities. Thus, positive affect and attitudes toward the team will promote high levels of performance adaptability above and beyond the effects of individual level training outcomes.

In sum, it is expected that team-related training outcomes, including team declarative knowledge, sharedness of knowledge structures, and team affect/attitudes will predict training adaptability above and beyond that of individual training outcomes. This is formally presented in the following hypothesis.

H1b: Team declarative knowledge, sharedness of structural knowledge, cohesion, and personal team-efficacy will be positively related to performance adaptability after controlling for individual training outcomes.

Influence of Self-Set Goals on Performance Adaptability

Goals have been shown to affect strategy, planning, and effort related to the attainment of goals. Goals activate self-regulatory mechanisms, influencing the attending to and interpretation of feedback in the task environment. They also stimulate attitudinal and affective reactions in response to perceived discrepancies, positive or negative, between the current environmental state and desired goal state. Thus, goals should influence training outcomes important for the adaptability of training.

H2: Self-set goals during training will influence performance adaptability.

The expected direction of the effect of goals on during training adaptation and generalization is somewhat ambiguous. A large body of literature has amassed demonstrating the pervasive positive effect of goals on performance (Locke & Latham, 1990). The positive effect of goals, however, seems to weaken or even reverse on

complex tasks (Earley et al., 1989; Kanfer et al., 1994), especially for individuals with limited cognitive resources, which are required to attend to task demands while monitoring goals and task performance (Kanfer & Ackerman, 1989).

The task environment for new team members working together to make decisions during evolving situations is quite complex. Thus, one might surmise that higher goals during training would lead to decreases in adaptable task performance. It is important to recognize, however, that many studies on skill acquisition in complex task environments have used assigned performance goals on each trial of performance. In contrast, the current study is investigating the influences of self-set goals on performance adaptability after training on a team task.

A training environment provides the opportunity to develop and build competencies important for adaptation and generalization of training. In order to acquire knowledge and skills important for performance adaptability, members of teams must have some goal that is above doing nothing. The higher the goal, the more likely team members will focus attention and effort to acquiring skills and knowledge relevant to the task at hand. As these skills and knowledge are developed, positive affective reactions will emerge (Bandura, 1991). Some research support exists for the positive effect of self-set goals or "do your best" goals on complex task skill acquisition. Earley et al. (1989) found individuals in a "do your best" goal condition outperformed individuals in specific, difficult goal conditions on a stock market prediction task. Similarly, Kanfer et al. (1994) found "do your best" goals led to higher performance on a complex task when performing under massed practice conditions. One might argue that higher goals will help only to a point because they become impossible to attain, and attention and motivation will drop or

individuals will become overwhelmed in response to task demands. However, individuals typically self-set goals that are within reasonable reach, and once they set goals, they work to minimize discrepancies between current performance and desired goal states (Bandura, 1991; Bandura & Cervone, 1986). Thus, self-set goals during training should positively influence development of knowledge and task skills relevant to performance adaptability.

Goals stimulate an elaborate sequence of cognitions to create a strategy or plan for achieving the goal. Plans and strategies are cognitively-based routines for attaining a particular objective, and they consist of multiple steps, some of which are elements needed to achieve other steps (Earley & Shalley, 1991; Ilgen et al., 1987). A plan may be conceptualized as a hierarchically organized structure, incorporating goals and subgoals, along with a specification of the temporal sequencing needed to enact them (Lord & Kernan, 1987). Plans are contained in schemas, or knowledge structures, that control attention and the storing and reconstruction of member knowledge. Thus, training outcomes may be positively enhanced through goals that stimulate thinking about the task. From this perspective, higher INDGLS should lead to higher performance adaptability for the team because they stimulate learning about the task.

It should be noted, however, that although commitment to individual performance and learning is important to high team output, if individuals are overly committed to maximizing their own performance, then INDGLS can become counterproductive for team performance (Mitchell & Silver, 1990). This is particularly true when members' commitment to maximizing individual performance exceeds their commitment to maximizing team performance (Crown & Rosse, 1995).

Thus, the level of focus for the goal can affect attention to individual or team performance (Crown & Rosse, 1995). TMGLS can facilitate team performance by directing attention to collective outcomes (Weingart, 1992; Weingart & Weldon, 1991; Weldon et al., 1991), and INDGLS can inhibit performance if they direct attention away from team outcomes (Crown & Rosse, 1995; Mitchell & Silver, 1990; Saavedra et al., 1993). This occurs because goals stimulate effort and strategy development, which in turn, influence performance. Strategies will influence performance positively only when they are appropriate to the demands of the task (Earley & Shalley, 1991).

Although research on TMGLS is not as extensive as that on individual goal-setting (Locke & Latham, 1990), particularly for self-set goals, tentative hypothesis can be proposed. Research has demonstrated that members working toward a collective goal usually outperform those working without a goal (O'Leary-Kelly et al., 1994; Weingart & Weldon, 1991). Collective goals improve the development of cooperative strategies and facilitate collective performance (Matsui et al., 1987; Mitchell & Silver, 1990; Weingart & Weldon, 1991). This is particularly true on interdependent tasks (Saavedra et al., 1993), because goals make particular task strategies more salient and influence motivational processes (Earley & Shalley, 1991; Wood & Locke, 1990). Thus, it is expected higher self-set TMGLS will generate more learning and higher performance adaptability.

H2a: Teams comprised of members who self-set high team goals during training will exhibit greater performance adaptability than teams comprised of members who self-set low team goals during training.

The influence of self-set INDGLS alone on performance adaptability is less clear. On the one hand, high individual self-set goals may help team performance because they

lead to higher levels of individual training outcomes which are important for team performance. On the other hand, high individual self-set goals may hurt team performance adaptability because they lead to a focus on individual outcomes at the cost of developing team-related competencies. For this reason, no specific hypothesis will be proposed regarding the effect of individual self-set goals on performance adaptability of the team.

The level of focus for a goal guides resources toward the development of knowledge, skills, and attitudes related to either individual or team performance. Although collective goals are clearly important for performance on an interdependent task, the influence of INDGLS cannot be overlooked. Team members who set high INDGLS and TMGLS are more likely to pursue strategies for achieving both that complement each other and which yield positive individual and team-related training outcomes. In contrast, team members who pursue only INDGLS will be less likely to develop competencies critical to performance adaptability for the team. Team members who set low INDGLS and TMGLS are likely to learn the least during training. This logic is supported by research conducted by Crown and Rosse (1995). They found INDGLS consistent with group task demands and group goals given in combination led to higher performance than either goal given alone. Based on the discussion and the limited research findings, it is hypothesized that high self-set INDGLS and TMGLS during training will interact to positively influence performance adaptability. This hypothesis is presented in Figure 6.

H2b: Teams comprised of members who self-set both high individual and team goals during training will exhibit more performance adaptability than teams comprised of members who self-set either low individual or team goals. Teams comprised of

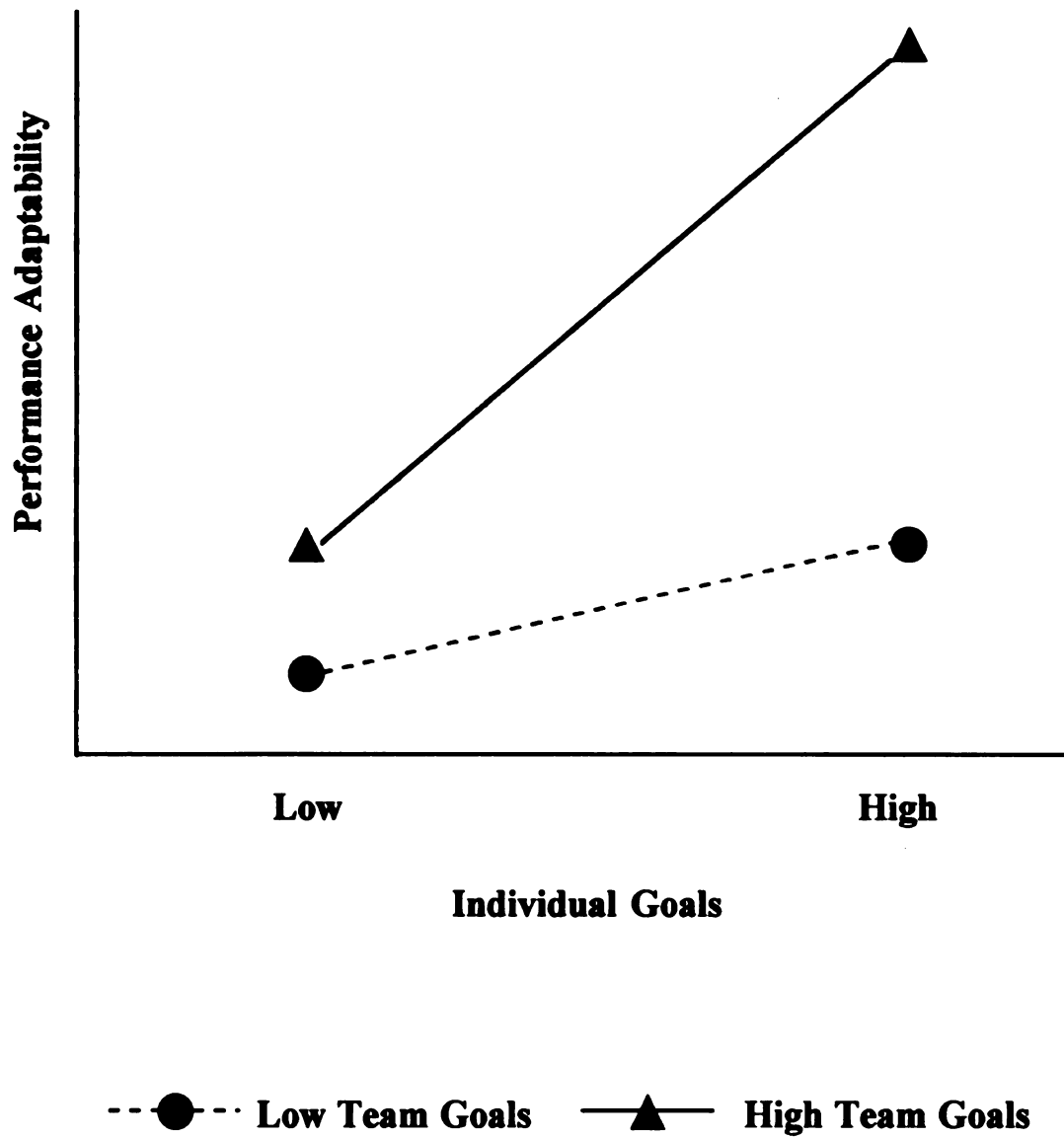


Figure 6. Interaction Effect of Individual and Team Goals on Performance Adaptability

members who self-set both low individual and team goals during training will exhibit the least amount of performance adaptability.

Influence of Self-Set Goals on Individual Training Outcomes

Thus far it has been argued that goals will focus attention and engage regulatory processes influencing the adaptable performance of the team. Key variables leading to performance adaptability include training outcomes. This is consistent with the notion that goals activate self-regulatory processes relevant to learning outcomes. It is hypothesized that self-set goals affect performance adaptability through their influence on training outcomes. Training outcomes can be described with reference to individually-related and team-related outcomes. Goals are expected to impact both, depending on their level of focus.

H3: Self-set goals during training will influence individual training outcomes.

The literature review on goal-setting demonstrates that individuals will maximize effort and cognitions related to goals. In general, the higher the goal, the greater the attention to plans and strategies related to the goal, and the higher the learning and performance. Although this effect seems to weaken for complex task environments, some evidence suggests higher self-set INDGLS will lead to higher levels of learning and skill acquisition. In particular, the negative effect of goals on performance of complex tasks typically refers to assigned goals. The influence of self-set goals on learning has been less well investigated, but Zimmerman, Bandura, and Martinez-Pons (1992) found self-efficacy (SEFF) and self-set goals predicted final course grades in social studies. Similarly, Phillips and Gully (in press) found SEFF and self-set goals predicted exam grades, even after controlling for ability. Less is known about the influence of self-set goals on skill

acquisition in complex team task environments. In spite of the limited research, based on the previous discussion, the following hypothesis is proposed regarding individual training outcomes.

H3a: Team members who self-set high individual goals during training will have more individual declarative knowledge, more coherent knowledge structures, and higher individual skills by the end of training than team members who self-set low individual goals during training.

Although self-set INDGLS are likely to lead to more positive individual training outcomes, the influence of self-set TMGLS on individual training outcomes is more ambiguous. High self-set TMGLS could lead to more positive individual training outcomes because TMGLS will encourage members to focus on improving knowledge and skills important to the team. For example, Matsui et al. (1987) found collective goals explained performance on an additive task even after ability, individual goal, and goal acceptance effects were removed. Collective goals influenced performance in part through effects on acceptance of INDGLS. Conversely, high self-set TMGLS could also lead to lower individual training outcomes because they direct attentional focus toward team-related competencies and away from individual competencies. It is tenuously expected that high self-set TMGLS will lead to higher individual training outcomes, but no formal hypothesis will be proposed.

An interaction between INDGLS and TMGLS in effects on individual training outcomes is hypothesized. Matsui et al. (1987) found collective goals could influence performance beyond INDGLS. Crown and Rosse (1995) found INDGLS and TMGLS together led to the highest levels of performance. Similarly, Mitchell and Silver (1990)

suggest their findings on a tower building task support the contention that collective goals plus INDGLS together result in high performance when people work interdependently. Most research, however, has focused on performance rather than training outcomes. Nevertheless, self-set TMGLS are likely to exert unique influences in combination with self-set INDGLS, so it is expected that the two will interact to yield positive effects on individual training outcomes. This interaction hypothesis is presented in Figure 7.

H3b: Team members who self-set both high individual and team goals during training will have higher individual declarative knowledge, more coherent knowledge structures, and higher individual skills by the end of training than team members who self-set either low individual or team goals. Team members who self-set both low individual and team goals during training will have the least amount of individual declarative knowledge, least coherent knowledge structures, and the lowest individual skills by the end of training.

In addition to influencing learning, goals have been shown to influence attitudinal and affective outcomes. These affective/attitudinal outcomes are primarily the result of a comparison process between a desired goal state and the current actual state (Bandura, 1986, 1991). When performance meets or exceeds goals, positive affective reactions occur, including higher SEFF and more task satisfaction. When performance fails to meet or exceed desired goals, SEFF and satisfaction tends to fall. Thus, the following hypothesis is proposed.

H3c: Team members who meet or exceed self-set individual goals by the end of training will have more self-efficacy and positive satisfaction than team members who do not meet or exceed individual goals by the end of training.

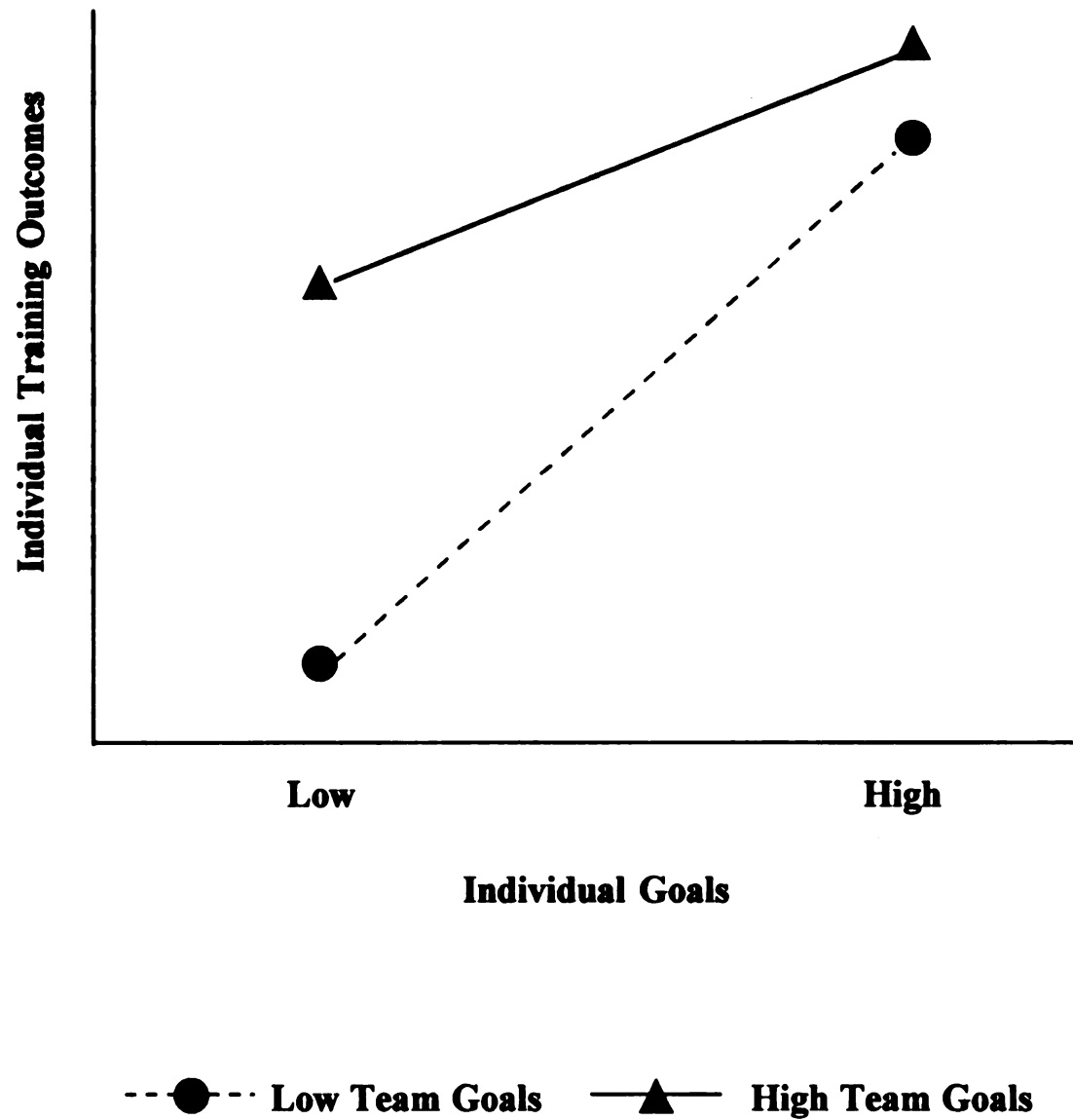


Figure 7. Interaction Effect of Individual and Team Goals on Individual Training Outcomes

The influence of meeting or exceeding self-set TMGLS during training on SEFF and satisfaction is unknown. Although no research has examined this issue, one can surmise that the effect of meeting or exceeding TMGLS is likely to be positive. This is because meeting a standard at any level of focus is apt to create positive feelings.

Although it is not clear how meeting or exceeding TMGLS alone will influence individual affective and attitudinal outcomes, such effects are likely to interact with individual goal effects. Meeting or exceeding both INDGLS and TMGLS will create a surge in positive affect and attitudes, stimulating high levels of SEFF and positive satisfaction. This interaction hypothesis is presented in Figure 8.

H3d: Team members who meet or exceed both self-set individual and team goals by the end of training will have more self-efficacy and satisfaction than team members who do not meet or exceed either self-set individual or team goals. Team members who do not meet or exceed both self-set individual and team goals by the end of training will have the least amount of self-efficacy and satisfaction.

Influence of Self-Set Goals on Team Training Outcomes

In addition to influencing individual training outcomes, goals will influence team training outcomes including team declarative knowledge, sharedness, and affect/attitudes.

H4: Self-set goals during training will influence team training outcomes.

The influence of self-set goals on team declarative knowledge will depend on the level of focus of the goal. High individual self-set goals can positively or negatively influence the acquisition of team declarative knowledge. High individual self-set goals could lead to more team declarative knowledge because individual declarative knowledge is a foundation for acquiring team knowledge. However, high individual self-set goals

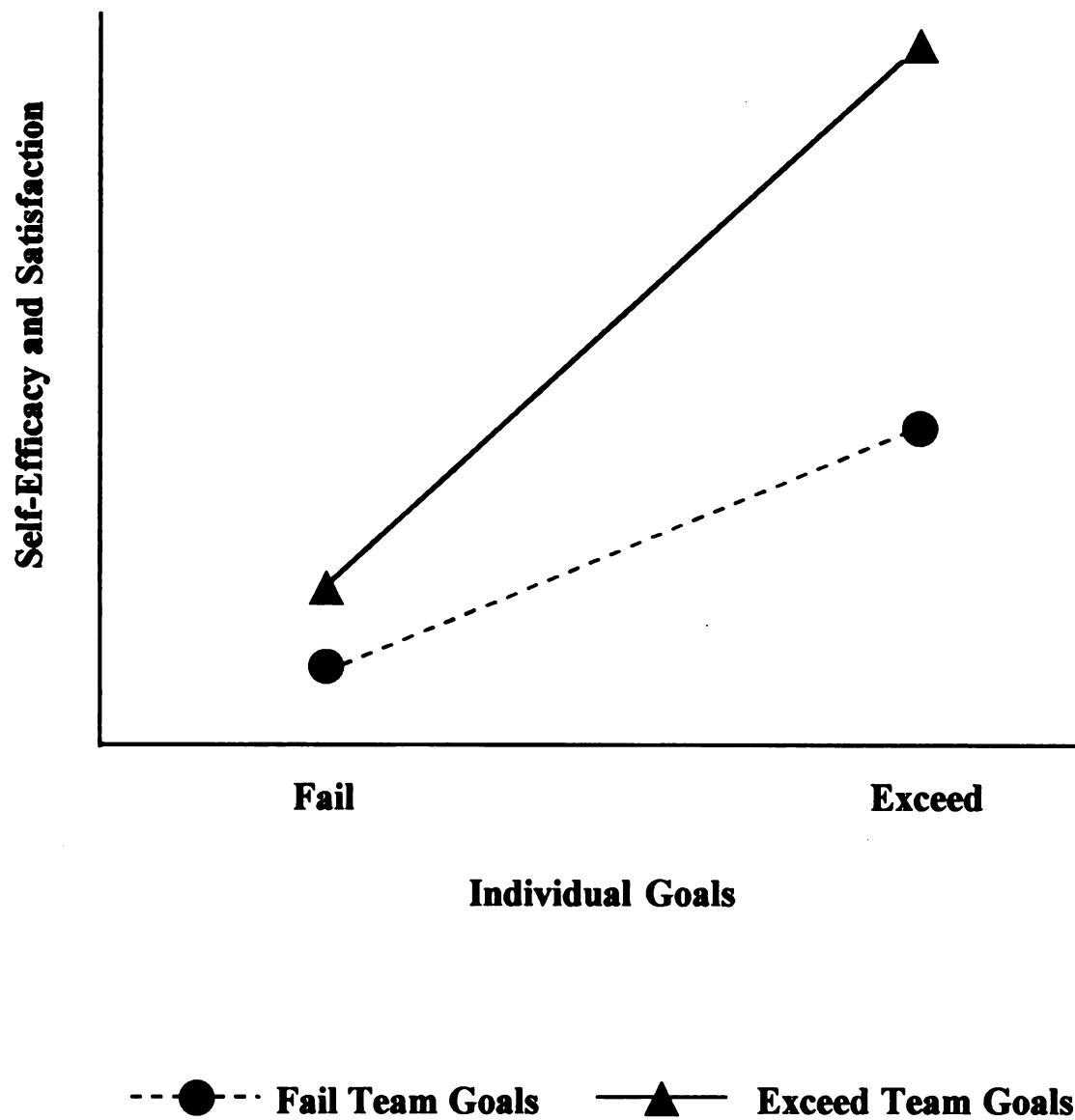


Figure 8. Interaction Effect of Exceeding or Failing to Meet Individual and Team Goals on Self-Efficacy and Satisfaction

could decrease team declarative knowledge because attentional focus and cognitions are directed toward individual improvement at the cost of team knowledge and skills. Because there is no research addressing this issue, no hypothesis will be presented.

Although the effect of INDGLS is unknown, it is clear that collective goals should lead to higher levels of team declarative knowledge. As members direct their attention to team outcomes, they will develop fundamental knowledge of how roles of each member are defined and acquire basic declarative knowledge of teamwork skills.

H4a: Team members who self-set higher team goals during training will have more team declarative knowledge by the end of training than team members who self-set lower team goals during training.

INDGLS and TMGLS are also expected to interact to yield the highest levels of team declarative knowledge when both INDGLS and TMGLS are high. When both INDGLS and TMGLS are low, team declarative knowledge should be quite low. This interaction is presented in Figure 9.

H4b: Team members who self-set both high individual and team goals during training will have more team declarative knowledge by the end of training than members who self-set either low individual or team goals. Team members who self-set both low individual and team goals during training will have the least amount of team declarative knowledge by the end of training.

Sharedness of knowledge structures and team skill by the end of training are team level training outcomes. Sharedness is a construct defined by relationships across team members. Similarly, team skill represents the compilation of individual coordinative,

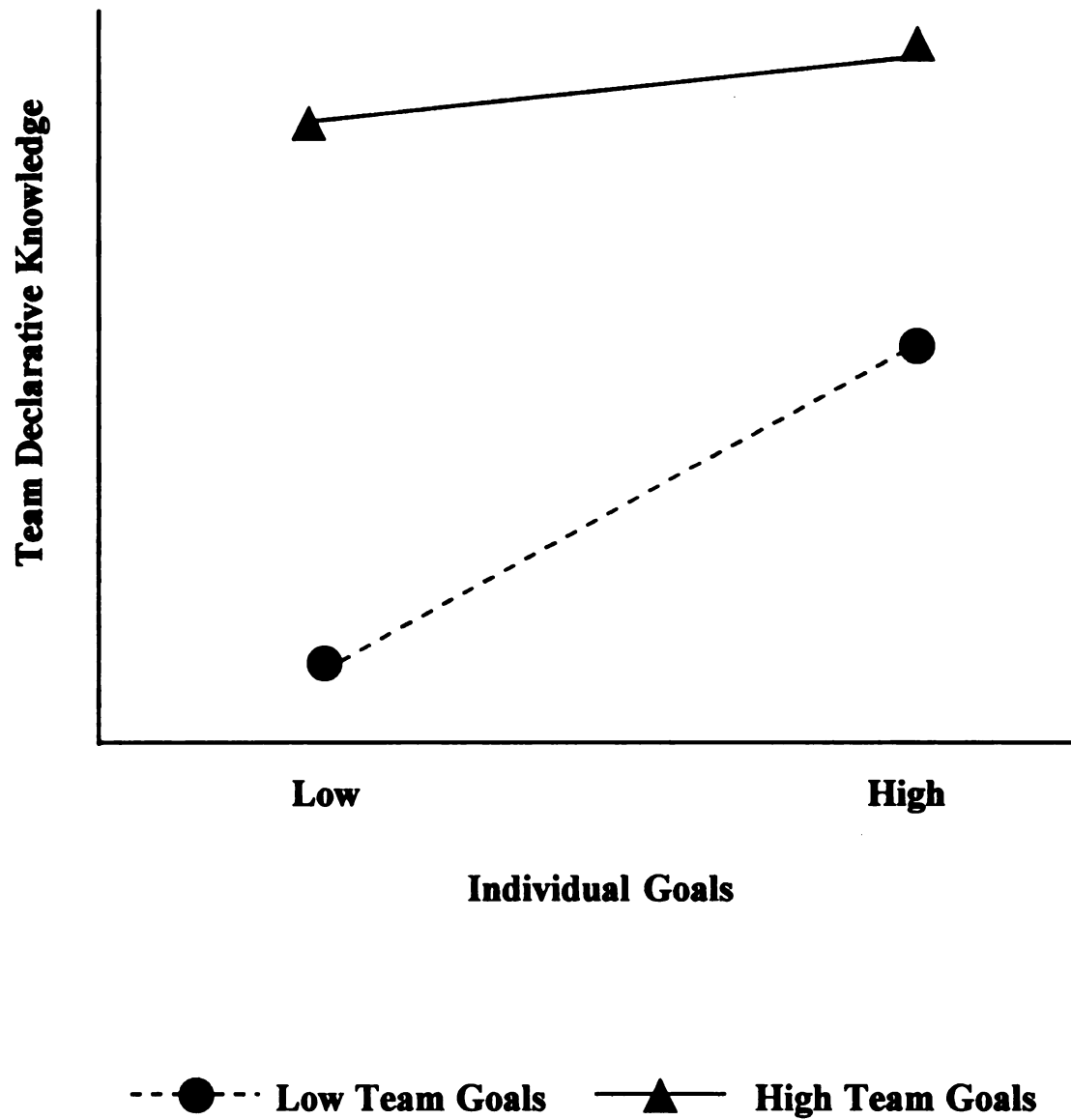


Figure 9. Interaction Effect of Individual and Team Goals on Team Declarative Knowledge

communicative, and cooperative behaviors unfolding during training. Teams that perform high by the end of training will tend to have more team skill than teams that do not.

The development of shared knowledge structures and team skill is facilitated by self-setting of high TMGLS. Teams that have members who set high TMGLS are more oriented toward team-related processes and outcomes. This attentional focus will facilitate the learning of skills, strategies, and routines relevant to the performance of team task activities. This, in turn, should encourage the development of knowledge structures that are consistent, or shared, across team members, and high levels of team training performance.

H4c: Teams comprised of members who self-set high team goals during training will exhibit greater sharedness of knowledge structures and greater team skill by the end of training than teams comprised of members who self-set low team goals during training.

The influence of high self-set INDGLS on team skills and knowledge structures is unknown. As noted before, INDGLS can either help or hinder the acquisition of team-related competencies. However, individual self-set goals are hypothesized to interact with team self-set goals to influence sharedness of knowledge structures and team skill. Those teams comprised of members who self-set high INDGLS and TMGLS will engage in learning of strategies and skill acquisition that are compatible with both goals. Thus, they should exhibit greater sharedness among members and greater team skill than teams with members who set low individual or TMGLS. Teams with members who set low goals in general will show the least amount of sharedness and lowest team skill. This interaction hypothesis is presented in Figure 10.

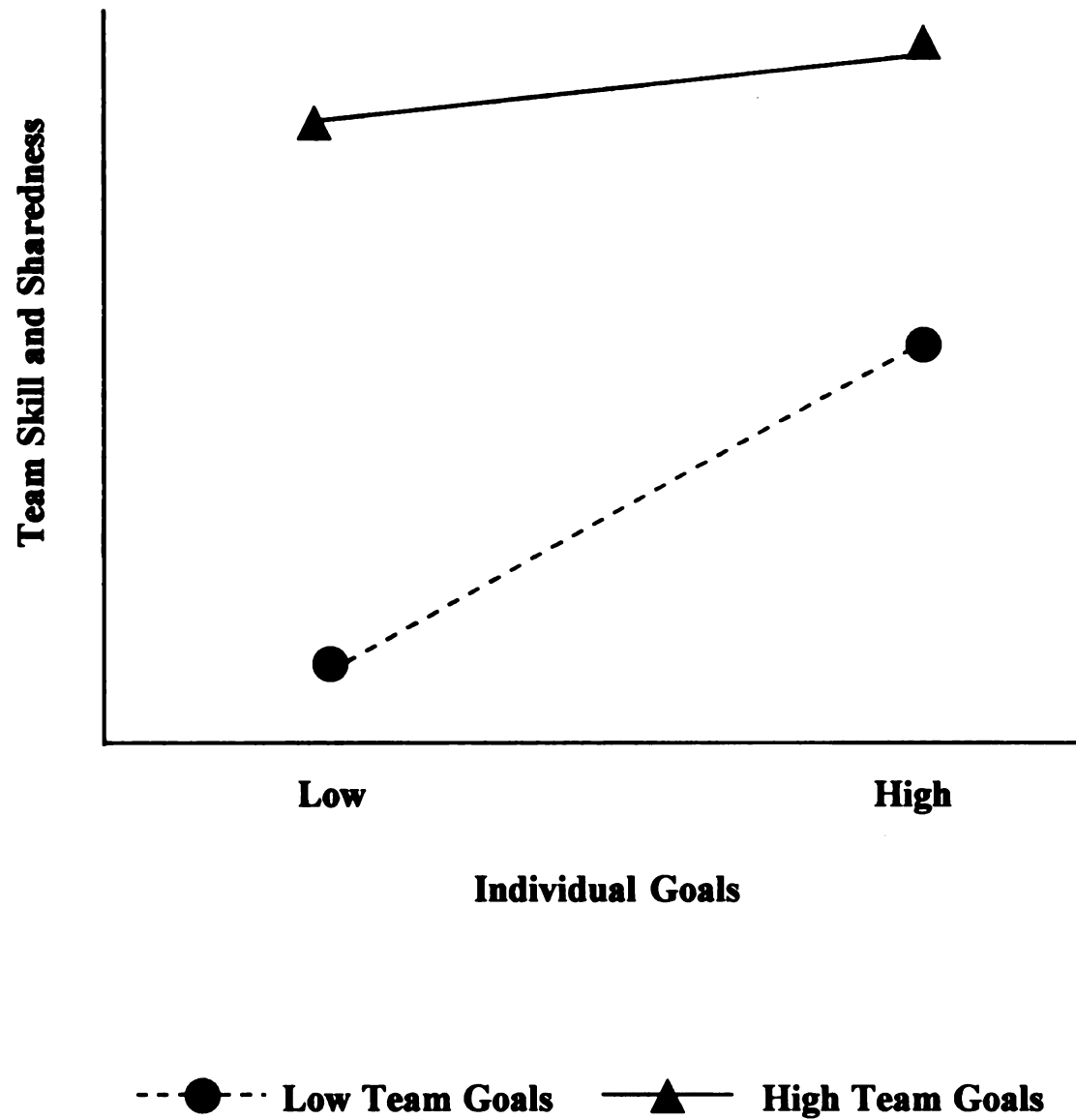


Figure 10. Interaction Effect of Individual and Team Goals on Team Skill and Sharedness

H4d: Teams comprised of members who self-set both high individual and team goals during training will exhibit greater sharedness of knowledge structures and greater team skill by the end of training than teams comprised of members who self-set either low individual or team goals. Teams comprised of members who self-set both low individual and team goals during training will exhibit the least amount of sharedness and team skill by the end of training.

Consistent with research on goals and efficacy at the individual level, it is hypothesized that meeting or exceeding self-set TMGLS will lead to higher levels of PTEFF and greater attraction to the team.

H4e: Team members who meet or exceed self-set team goals by the end of training will have more personal team-efficacy and cohesion than team members who do not meet or exceed self-set team goals by the end of training.

The effect of meeting or exceeding self-set INDGLS on PTEFF and attraction to the team is unknown. This effect is expected to be positive, because meeting or exceeding goals at an individual level of focus will generate positive affect and attitudes. Meeting or exceeding both self-set INDGLS and TMGLS will create positive affect that can build on both forms of goal attainment. Thus, an interaction between meeting or exceeding both INDGLS and TMGLS is hypothesized. This is illustrated in Figure 11.

H4f: Team members who meet or exceed both self-set individual and team goals by the end of training will have more personal team-efficacy and cohesion than team members who do not meet or exceed either self-set individual or team goals by the end of training. Team members who do not meet or exceed both self-set individual

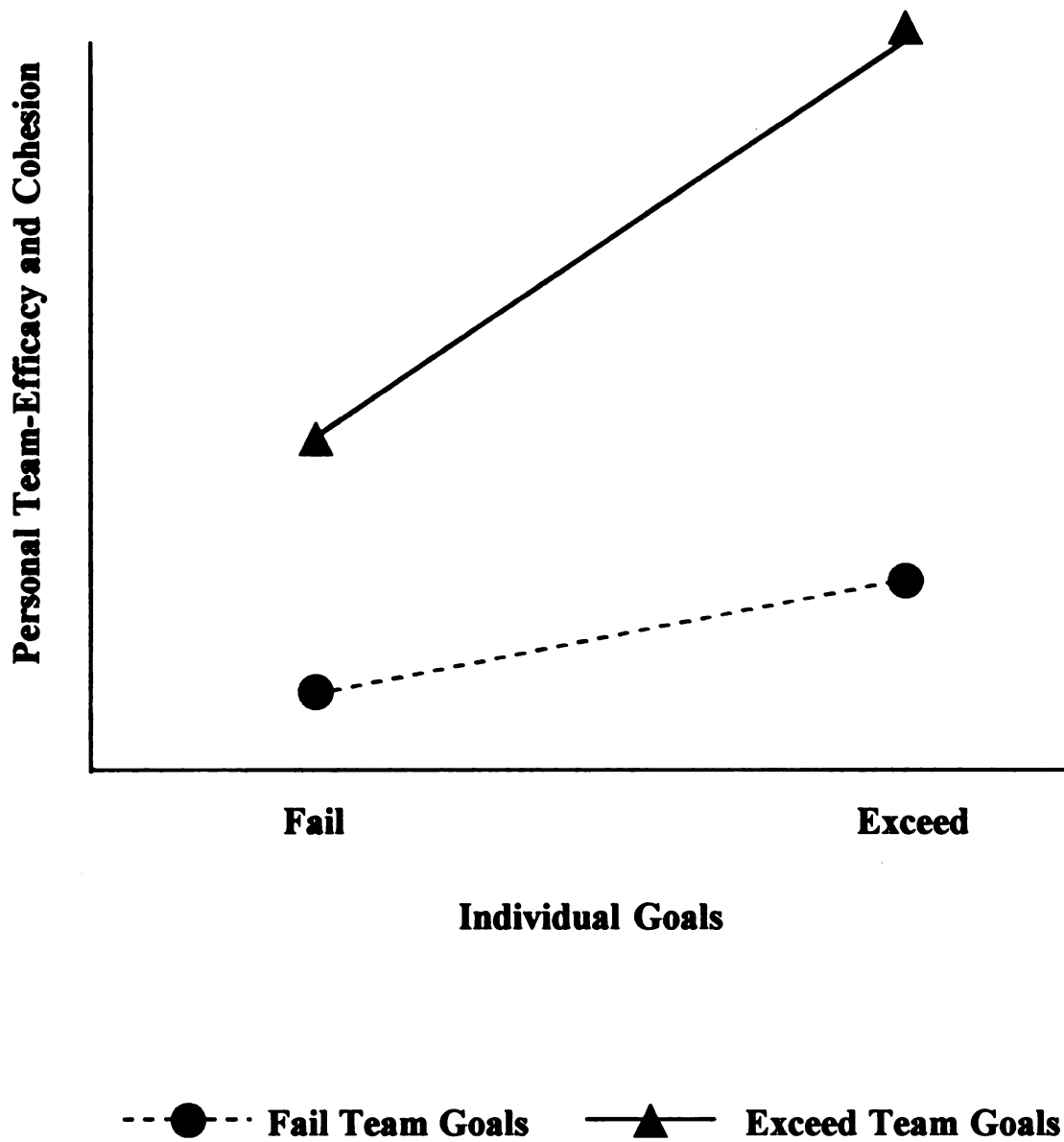


Figure 11. Interaction Effect of Exceeding or Failing to Meet Individual and Team Goals on Personal Team-Efficacy and Cohesion

and team goals by the end of training will have the least amount of personal team-
efficacy and cohesion.

Influence of Perceptions of Efficacy on Performance Adaptability

SEFF has been consistently shown to be important as a training outcome.

Similarly, efficacy perceptions about a collective unit have been related to performance of the unit. Although no research exists on the influence of PTEFF on performance adaptability, it is expected that it will exert nontrivial effects on performance under new or novel conditions. Thus, it is predicted that perceptions of efficacy will influence adaptability of performance.

H5: Perceptions of efficacy during training will influence performance adaptability.

SEFF has been shown to have powerful direct effects on performance (Bandura, 1986), even after controlling for goal effects (Latham & Locke, 1991). However, the influence of SEFF alone on performance adaptability in a team context is unknown. SEFF may help performance of team members under novel conditions because it provides resilience in the face of adverse task demands (Wood & Bandura, 1989) and stimulates the setting of high INDGLS and the development of individual skills which are important for team performance. Research has demonstrated that SEFF is positively related to performance in a wide variety of task contexts.

Conversely, high levels of SEFF may hurt team performance in new situations because it generates a focus on INDGLS and skills at the cost of developing team-oriented goals and skills. For example, Zajonc (1962) demonstrated that group members whose performance levels are high are more involved in their individual tasks than the group task, and are more concerned with their personal successes and failures than with the success of

the group as a whole. This provides indirect support for the notion that the influence of SEFF on adaptability of team performance will be negative. No formal hypothesis is proposed, but effects are expected to be positive because of the large body of research on the positive effects of SEFF on a wide variety of tasks.

The literature on the influence of PTEFF is less ambiguous. Highly efficacious teams will have more success in achieving goals and higher performance than low efficacy teams (Bandura, 1986; Guzzo et al., 1993; Shea & Guzzo, 1987b; Zander, 1985). PTEFF and related constructs have been linked to positive collective outcomes and performance.

H5a: Teams comprised of members who are high in personal team-efficacy during training will exhibit greater performance adaptability than teams comprised of members who are low in personal team-efficacy during training.

Although PTEFF is clearly important to performance adaptability, the effects of SEFF on team performance under novel conditions cannot be overlooked. The influence of SEFF alone on team effectiveness may be ambiguous, but the interactive influence of PTEFF and SEFF is expected to be positive. Teams with members who are efficacious in their roles and about the team as a unit will be more motivated, work harder, and set higher goals than teams with members who are not efficacious. Such teams will outperform teams that are low on one or more dimensions of efficacy. This hypothesis is presented in Figure 12.

H5b: Teams comprised of members who are high in both self-efficacy and personal team-efficacy during training will exhibit greater performance adaptability than teams comprised of members who are low in either self-efficacy or personal team-efficacy. Teams comprised of members who are low in both self-efficacy and

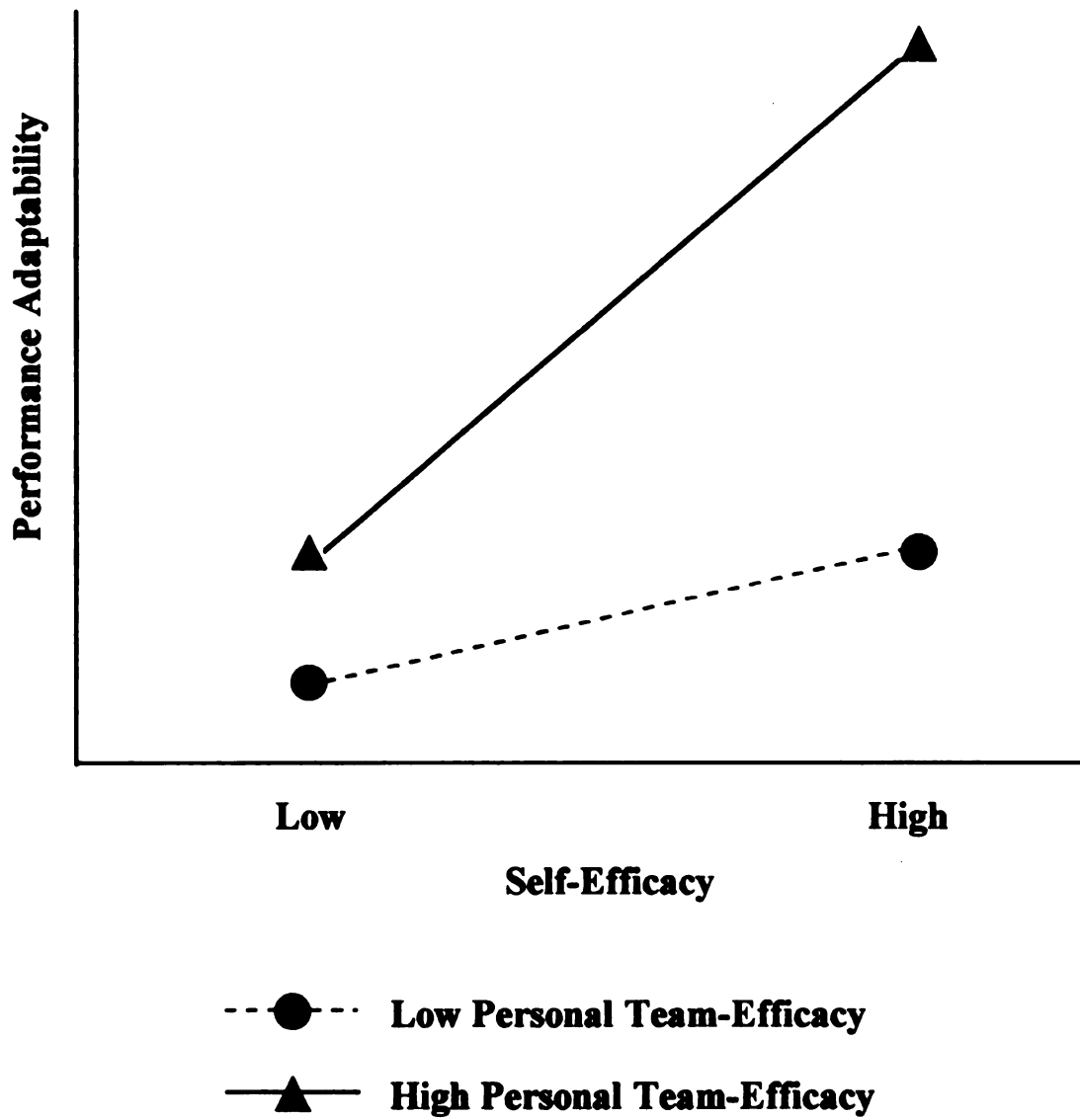


Figure 12. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Performance Adaptability

personal team-efficacy during training will exhibit the least amount of performance adaptability.

Influence of Perceptions of Efficacy on Individual Training Outcomes

The previous section discussed the effects of efficacy perceptions on performance adaptability. Efficacy perceptions will influence adaptability of performance at least partially through influences on individual and team training outcomes.

H6: Perceptions of efficacy during training will influence individual training outcomes.

Consistent with previous research, SEFF is expected to have positive effects on individual training outcomes. The higher the SEFF during training, the more positive the individual training outcomes.

H6a: Team members who are high in self-efficacy during training will have more individual declarative knowledge, more coherent knowledge structures, higher individual skills, and more positive individual attitudinal and affective outcomes by the end of training than team members who are low in self-efficacy during training.

As with goals, the level of focus of the efficacy perceptions will differentially influence training outcomes. The influence of PTEFF on individual declarative knowledge, coherence of knowledge structures, individual skills, and individually-oriented affect is unknown. PTEFF could positively influence individual training outcomes because it will generate positive affect and encourage members to focus on improving knowledge and skills important to team effectiveness. PTEFF could also negatively influence individual training outcomes because it diverts attention away from the learning of individual skills. The conceptual model suggests, however, that PTEFF and SEFF will interact to positively influence individual training outcomes. As presented in Figure 13, members who are high

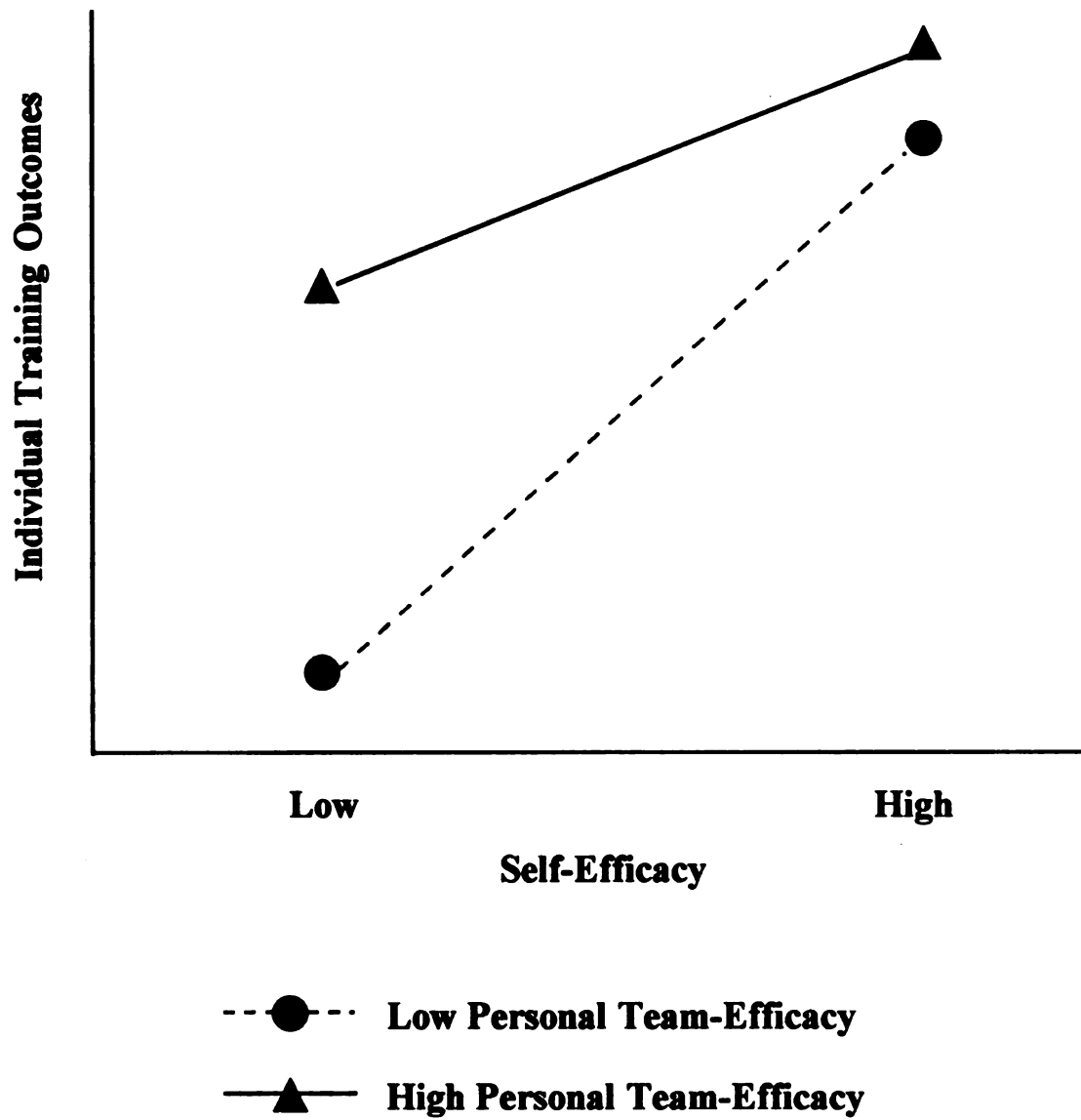


Figure 13. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Individual Training Outcomes

in both SEFF and PTEFF are expected to have higher individual training outcomes than members who are low on either or both forms of efficacy.

H6b: Team members who are high in both self-efficacy and personal team-efficacy during training will have higher individual declarative knowledge, more coherent knowledge structures, higher individual skills, and more positive individual attitudinal and affective outcomes by the end of training than team members who are low in either self-efficacy or personal team-efficacy. Team members who are low in both self-efficacy and personal team-efficacy during training will have the least amount of individual declarative knowledge, least coherent knowledge structures, lowest individual skills, and least positive attitudinal and affective outcomes by the end of training.

Influence of Perceptions of Efficacy on Team Training Outcomes

In addition to influencing individual training outcomes, perceptions of efficacy are expected to affect team training outcomes. Perceptions of efficacy at both levels of focus are expected to influence team training outcomes.

H7: Perceptions of efficacy will influence team training outcomes.

The influence of SEFF alone on team declarative knowledge is unknown. It could help the development of such knowledge because individual training outcomes are the foundation for team knowledge and skills. High SEFF could also hurt the development of such knowledge because it stimulates the setting of higher INDGLS and directs attentional focus toward individual improvement at the cost of team knowledge and skills. As Zajonc (1962) noted, members who are individually proficient forego attention to the collective task and become focused on individual success.

In contrast, the effects of PTEFF on team training outcomes is expected to be uniformly positive. Team members who are high in PTEFF will develop more team declarative knowledge because it will orient them toward collective outcomes (Bandura, 1982, 1986).

H7a: Team members who are high in personal team-efficacy during training will have more team declarative knowledge by the end of training than team members who are low in personal team-efficacy during training.

SEFF and PTEFF are expected to interact to yield high amounts of team declarative knowledge. When both are high, goals, motivation, attention, and team declarative knowledge will be high. When either or both are low, team declarative knowledge will be lower. This interaction hypothesis is formally stated below and presented in Figure 14.

H7b: Team members who are high in both self-efficacy and personal team-efficacy during training will have more team declarative knowledge by the end of training than members who are low in either self-efficacy or personal team-efficacy. Team members who are low in both self-efficacy and personal team-efficacy during will have the least amount of team declarative knowledge by the end of training.

In addition to positively influencing team declarative knowledge, PTEFF will influence sharedness of knowledge structures and team skill. Teams comprised of members high in PTEFF will develop greater sharedness of knowledge and more proficient team skill than teams comprised of members low in PTEFF.

H7c: Teams comprised of members who are high in personal team-efficacy during training will exhibit greater sharedness of knowledge structures and greater team skill by

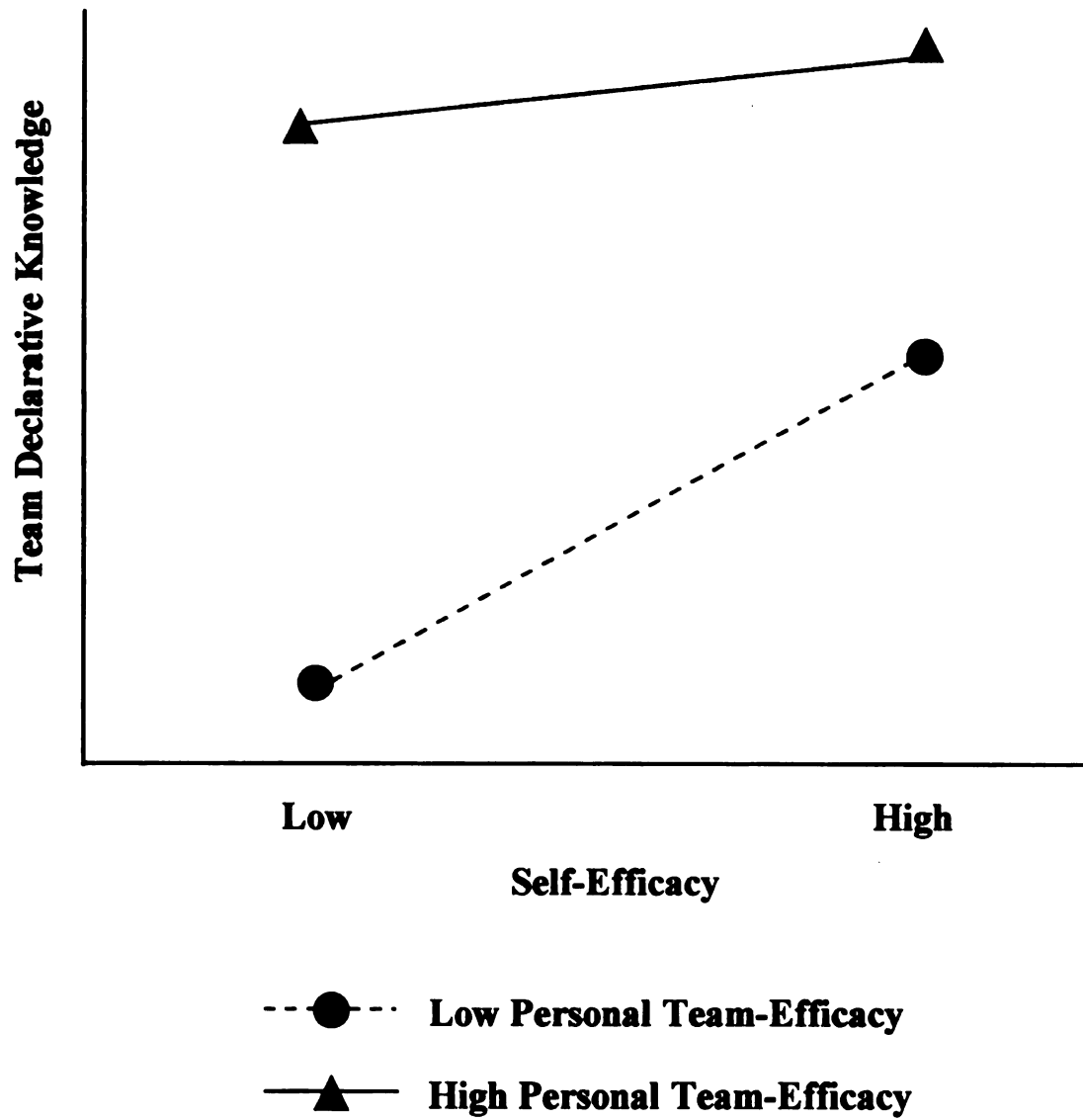


Figure 14. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Team Declarative Knowledge

the end of training than teams comprised of members who are low in personal team-efficacy during training.

PTEFF and SEFF are hypothesized to interact in their influence on team skill and sharedness. This interaction is presented in Figure 15. Teams comprised of members who are high in PTEFF and SEFF are expected to develop the highest levels of team skill and sharedness. Teams comprised of members who are low in both forms of efficacy will develop the lowest amounts of team skill and sharedness.

H7d: Teams comprised of members who are high in both self-efficacy and personal team-efficacy during training will have more sharedness of knowledge structures and team skill by the end of training than teams comprised of members who are low in either self-efficacy or personal team-efficacy. Teams comprised of members who are low in both self-efficacy and personal team-efficacy during training will have the least amount of sharedness in knowledge structures and the lowest team skill by the end of training.

The influence of each form of efficacy perception on attitudinal and affective outcomes is likely to be positive. In particular, high PTEFF should lead to more positive team attitudinal and affective outcomes than low PTEFF.

H7e: Team members who are high in personal team-efficacy during training will have more positive team attitudinal and affective outcomes by the end of training than team members who are low in personal team-efficacy during training.

The interacting influence of SEFF with PTEFF on team-oriented affective and attitudinal outcomes should be positive. Team members who are high in both forms of

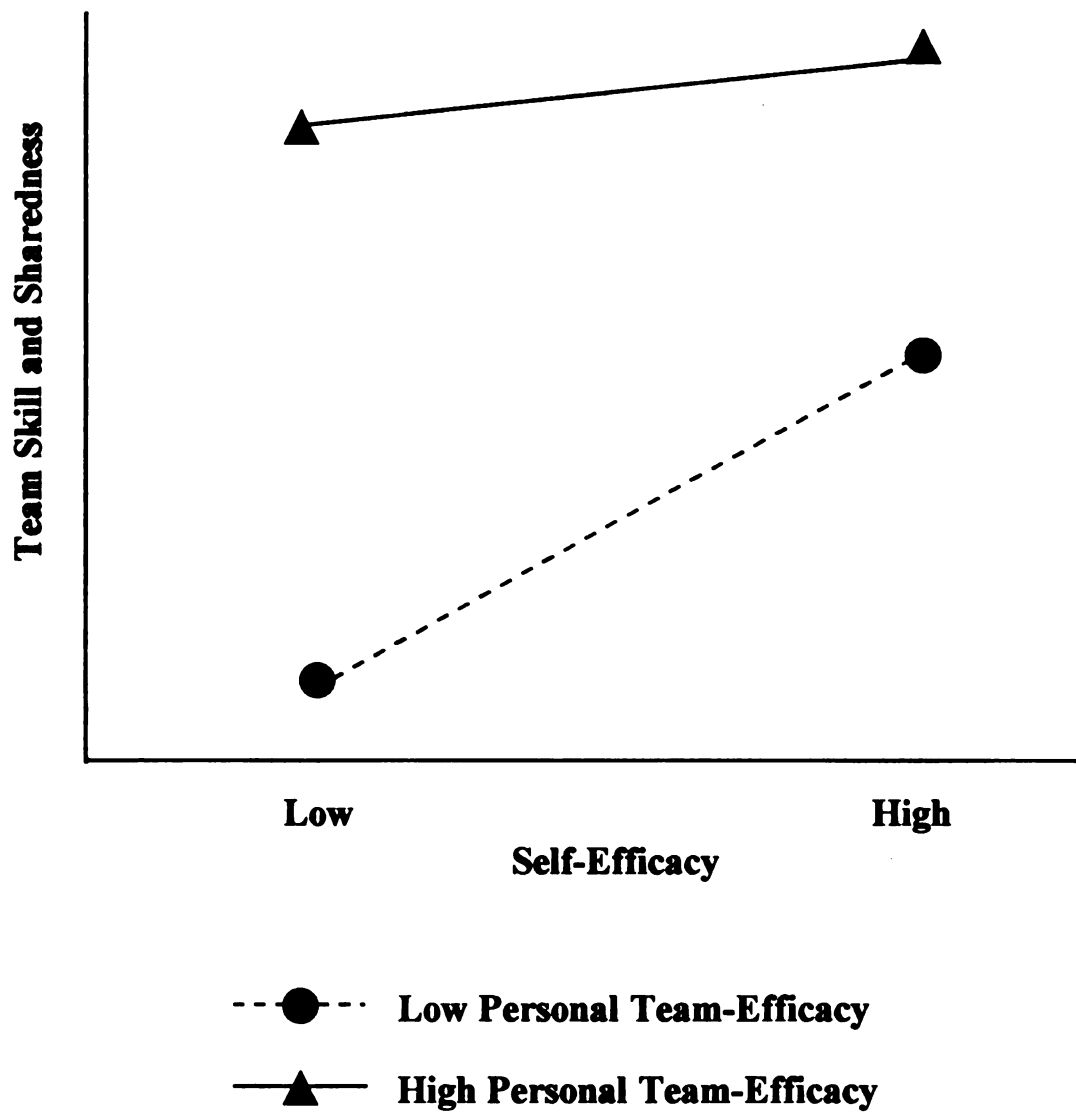


Figure 15. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Team Skill and Sharedness

efficacy should be highest in team attitude and affect by the end of training. This hypothesis is presented in Figure 16.

H7f: Team members who are high in both self-efficacy and personal team-efficacy during training will have more positive team attitudinal and affective outcomes by the end of training than team members who are low in either self-efficacy or personal team-efficacy. Team members who are low in both self-efficacy and personal team-efficacy during training will have the least positive team attitudinal and affective outcomes by the end of training.

Influence of Efficacy Perceptions on Self-Set Individual Goals

Bandura (1982, 1986) suggests the factors that affect goal choice and commitment are those which convince people achieving a goal is possible and those which convince them that achieving the goal is important or appropriate. The probability of choosing a given goal is increased if an individual thinks it can be attained either because of ability or past success. People with high efficacy perceptions are more likely to choose high goals than those with low efficacy perceptions (Latham & Locke, 1991; Locke & Latham, 1990). Thus, efficacy perceptions are expected to influence setting of INDGLS in a team training context.

H8: Perceptions of efficacy during training will influence self-setting of individual goals during training.

SEFF has been shown to affect individual goal choice and commitment (Bandura & Wood, 1989; Latham & Locke, 1991; Locke & Latham, 1990). People high in SEFF set higher goals and remain more committed to them than people low in SEFF. Similar effects are expected in the team training environment.

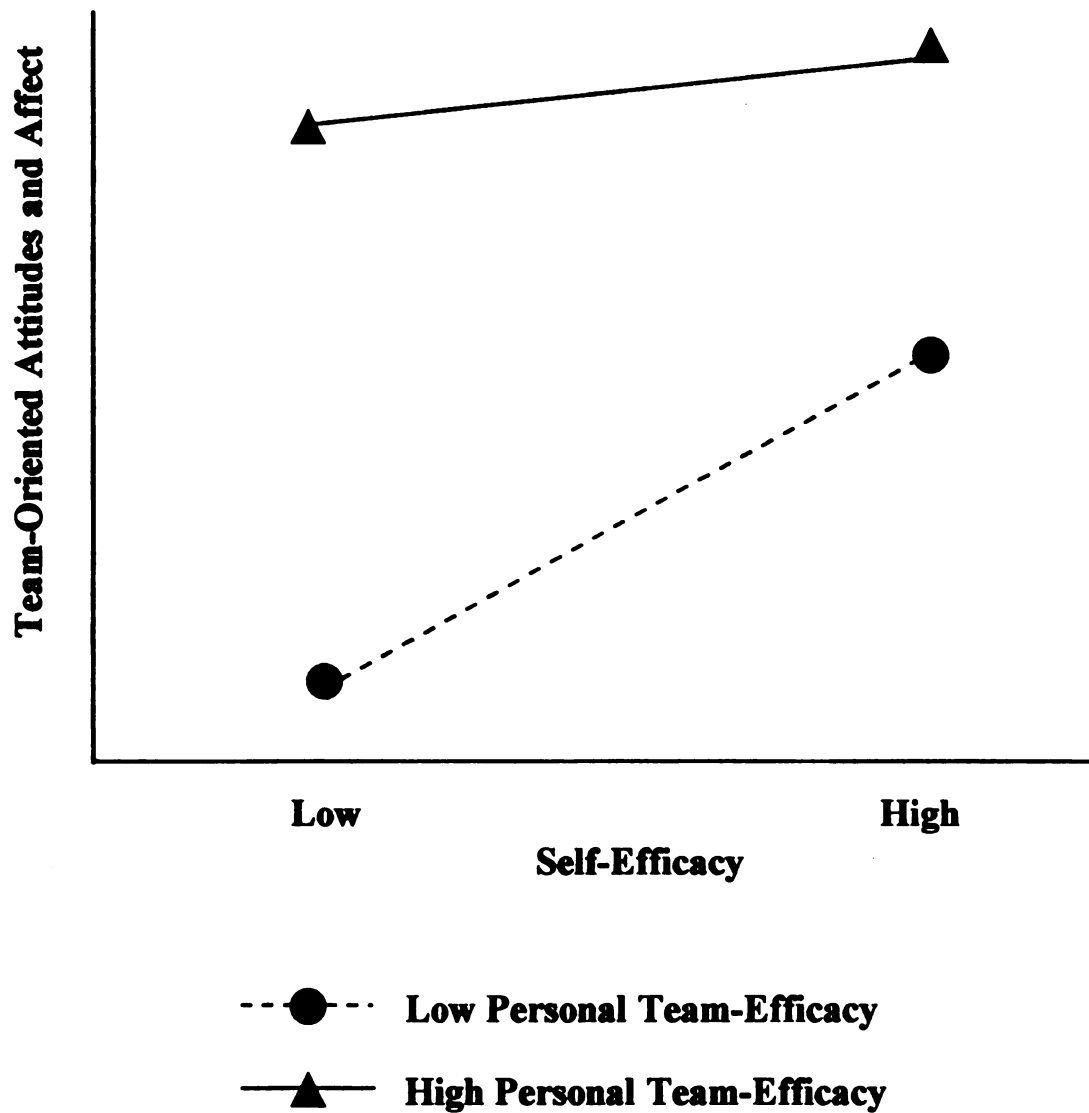


Figure 16. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Team-Oriented Attitudes and Affect

H8a: Team members who are high in self-efficacy during training will set higher individual goals during training than team members who are low in self-efficacy.

It is not clear how PTEFF will influence the setting of INDGLS. One might expect PTEFF to lead to the setting of higher INDGLS, but this is not necessarily true.

Individuals may feel quite confident in the team as a unit, yet feel incapable of reaching a lower goal on his or her task performance. However, this effect is unlikely. The effect of PTEFF on the setting of INDGLS is expected to be positive and to interact with SEFF.

The interaction is presented in Figure 17. Members who are high in both SEFF and PTEFF should self-set INDGLS that are higher than members who are low in one or both forms of efficacy.

H8b: Team members who are high in both self-efficacy and personal team-efficacy during training will set higher individual goals during training than team members who are low in either self-efficacy or personal team-efficacy. Team members who are low in both self-efficacy and personal team-efficacy during training will set the lowest individual goals.

Influence of Efficacy Perceptions on Self-Set Team Goals

Different factors can influence individual members' choices of collective goals.

These may include perceptions of the performance level that can be reasonably attained, satisfaction associated with various levels of team achievement, and variations in members' desire for team success (Zander, 1968, 1971, 1985). Based on the conceptual model, key variables influencing goal choice include individual and team-oriented efficacy perceptions.

H9: Perceptions of efficacy during training will influence self-setting of team goals during training.



Figure 17. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Individual Goals

Bandura (1982, p. 143) stated, "perceived collective efficacy will influence what people choose to do as a group, how much effort they put into it, and their staying power when group efforts fail to produce results." In other words, efficacy will affect the setting of and commitment to group goals. Mulvey, Bowes-Sperry, and Klein (1995) found group efficacy was related to group goal difficulty and group performance. Similarly, PTEFF is expected to be positively related to setting of TMGLS.

H9a: Team members who are high in personal team-efficacy during training will set higher team goals than team members who are low in personal team-efficacy.

The influence of SEFF on setting of TMGLS during training is unknown, but it is likely to be positive. SEFF and PTEFF should also interact to influence the setting of TMGLS. This interaction is presented in Figure 18. When individual members believe they can perform their tasks and roles well and when they believe the team can function effectively as a unit, they will set higher TMGLS than when individual members do not have efficacious perceptions.

H9b: Team members who are high in both self-efficacy and personal team-efficacy during training will set higher team goals than team members who are low in either self-efficacy or personal team-efficacy. Team members who are low in both self-efficacy and personal team-efficacy during training will set the lowest team goals.

Influence of Level of Feedback on Performance Adaptability

In addition to goals and efficacy perceptions, feedback is an important component of the self-regulatory process. Feedback is defined as information provided by the task regarding individual or team performance outcomes. Feedback can provide information crucial to learning as well as engage motivational and self-regulatory mechanisms (Ilgen et

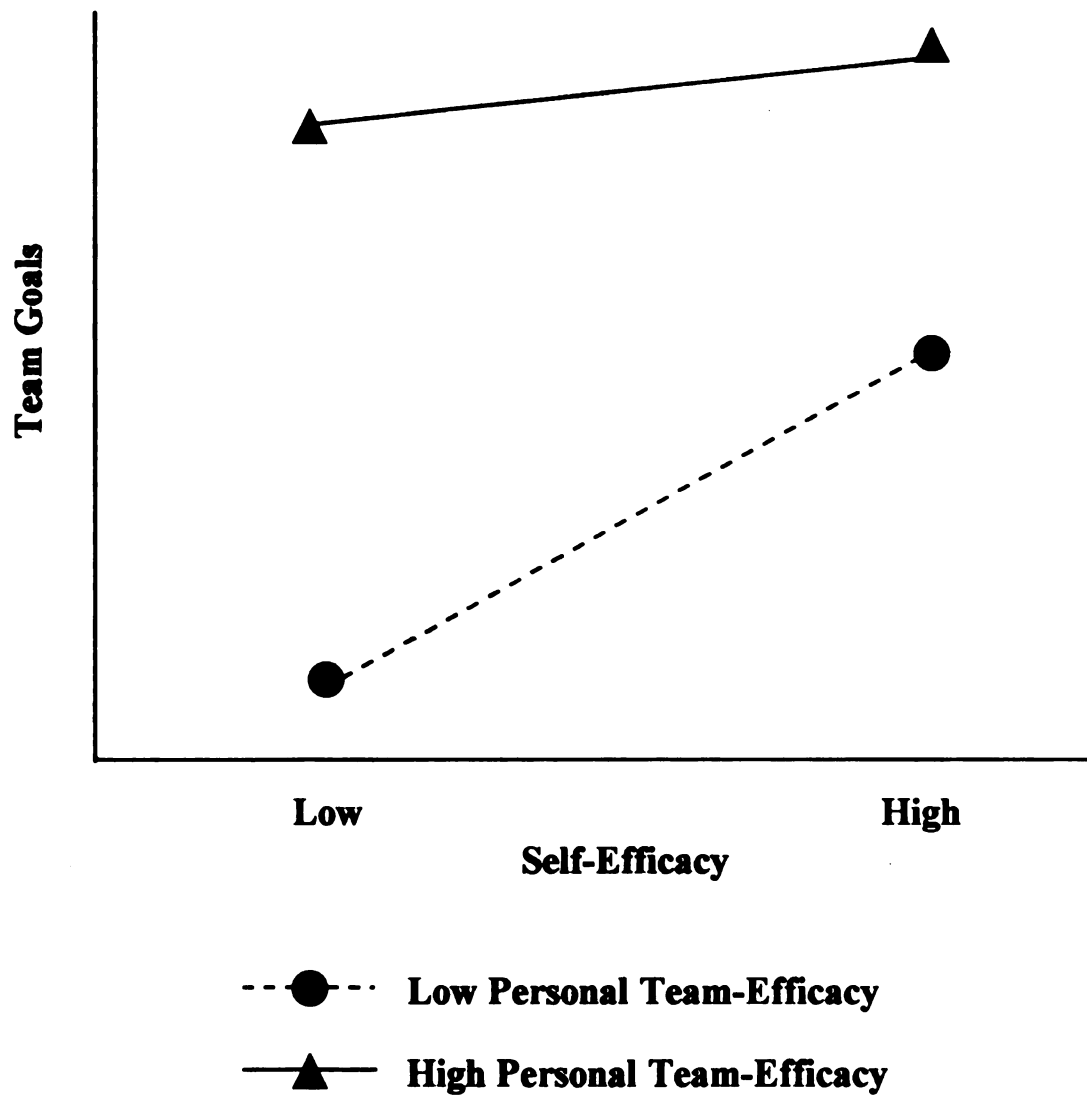


Figure 18. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Team Goals

al., 1979; Taylor et al., 1984). These mechanisms are highlighted in an experiment performed by Briggs and Johnston (1966). They did an experiment in which two-person teams of radar controllers received simple criterion feedback during training. When the same teams were placed into new training conditions with different criteria and feedback, the teams adapted performance rapidly to a new simple criterion. Upon placement into conditions with complex criteria, however, the teams continued to emphasize that aspect of performance previously appropriate during the simple criterion training conditions.

Several researchers have noted that perhaps the most important factor to consider in team training design is the nature of the performance feedback given to team members. Feedback enables team members to perform their tasks competently and demonstrates the contribution of that person's performance to the team. Researchers agree that feedback about the effectiveness of task performance should be provided to team members (Dyer, 1984; Salas et al., 1992). Based on this discussion, the following hypothesis is proposed.

H10: Level of focus of feedback present during training will influence performance adaptability.

The influence of individual feedback alone on performance adaptability is likely to be positive, but limited. Individual feedback directs member attention to their individual goals, strategies, and learning which are important for the acquisition of basic task skills. Individual feedback, however, does not provide information regarding the cumulative performance of the team as a unit. The performance of the team on an interdependent task is not the simple summation of individual performances. Members require information regarding the performance of the team as a unit in order to set appropriate goals and learn aspects of teamwork critical to effective team performance. Thus, team feedback provides

important information that orients members to regulate around team learning and team performance outcomes.

H10a: Teams comprised of members who receive team feedback during training will exhibit greater performance adaptability than teams comprised of members who do not receive team feedback during training.

Team feedback provides information regarding the performance of the team as a unit, but this information is "confounded" with the actions of other members. Individual feedback is important in the acquisition of specific individual task skills, and team feedback provides limited information about the quality of individual performance. When team feedback alone is provided, individual members may not be able to use such information effectively to learn (Salas et al., 1992). As a result, team feedback provides information that is diagnostic for team-related processes, but limited in usefulness for diagnosing individual member performance.

Although a fair amount of research has focused on the effects of either individual-level or group-level feedback on motivation and performance, little empirical work has attempted to understand how these two levels of feedback operate together (Tindale, Kulik, & Scott, 1991). Initial work suggests the influence of task feedback is maximized when members receive both individual and collective feedback (Matsui et al., 1987). Feedback on individual and team performance maximizes identifiability of performance outcomes, and influences learning and motivation. Zajonc (1962) found providing individual feedback and group feedback together leads to the highest performance. Similarly, Zander (1971) found providing feedback on the group as well as on individual

scores leads to higher performance. This research and the preceding discussion yield the following hypothesis which is presented in Figure 19.

H10b: Teams comprised of members who receive both individual and team feedback during training will exhibit greater performance adaptability than teams comprised of members who receive only individual or team feedback. Teams comprised of members receiving neither individual nor team feedback during training will exhibit the least amount of performance adaptability.

Influence of Level of Feedback on Individual Training Outcomes

In addition to influencing performance adaptability, feedback will influence individual and team training outcomes. This section will discuss the effects of feedback on individual training outcomes. The effect of feedback on these outcomes, however, depends on the specificity of the feedback (Cusella, 1987; Ilgen et al., 1979).

H11: Level of focus of feedback present during training will influence individual training outcomes.

Individual feedback provides specificity and information not available in team feedback. It is not clear what effect team feedback will have on individual training outcomes. The effect of individual feedback is more clear. Consistent with previous research, it is hypothesized that individual feedback will lead to more positive individually-oriented training outcomes.

H11a: Teams comprised of members who receive individual feedback during training will exhibit more individual declarative knowledge, coherence of knowledge structures, and individual skills by the end of training than teams comprised of members who do not receive individual feedback during training.

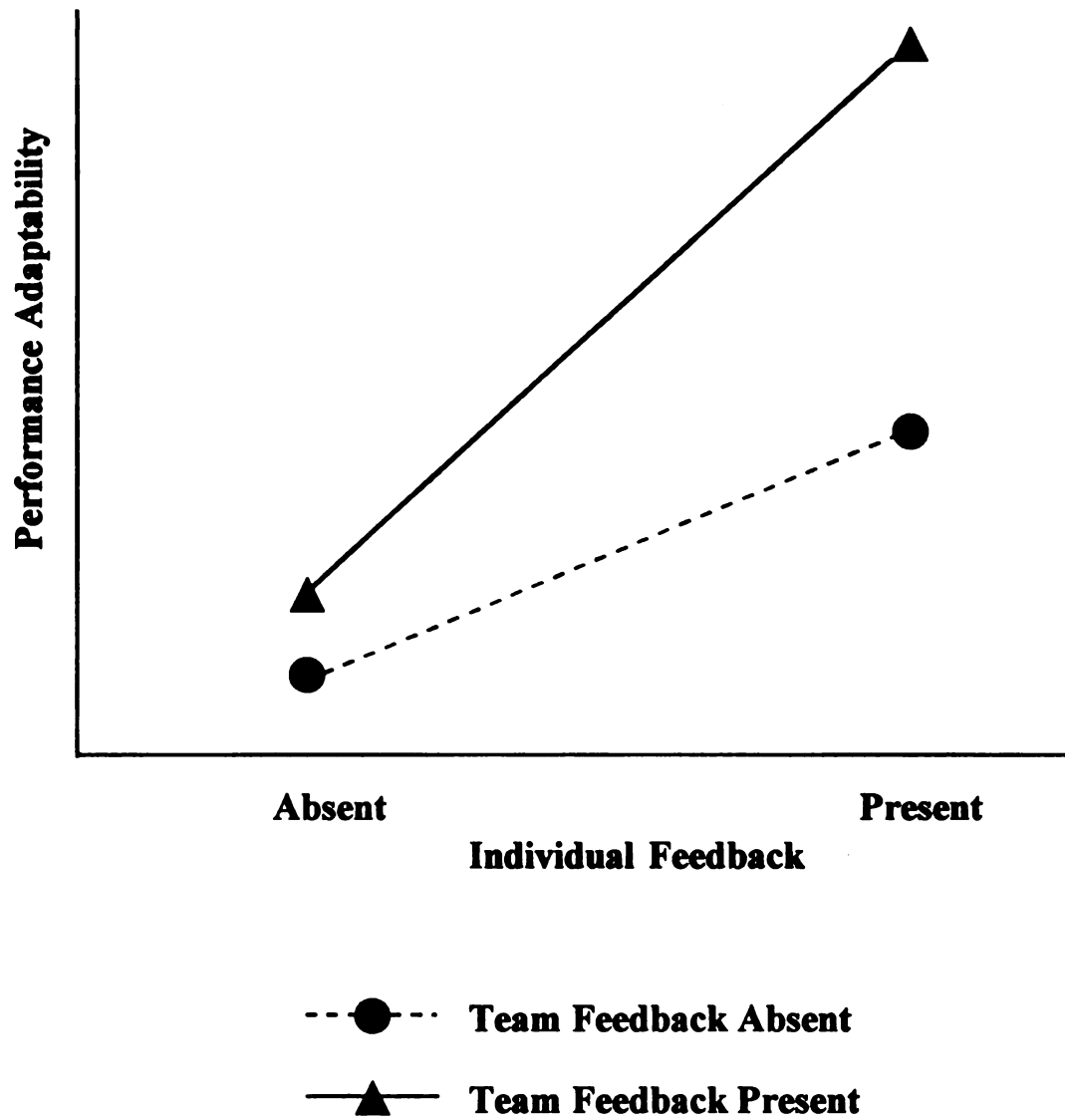


Figure 19. Interaction Effect of Presence of Individual and Team Feedback on Performance Adaptability

The effects of individual and team feedback are also hypothesized to interact, each providing a unique source of information and stimulating goal setting and development of efficacy relevant to the acquisition of individual knowledge and skills. This interaction is presented in Figure 20. The presence of individual and team feedback together should lead to higher levels of learning than when either or both are not available.

H11b: Teams comprised of members who receive both individual and team feedback during training will exhibit more individual declarative knowledge, coherence of knowledge structures, and individual skills by the end of training than teams comprised of members who receive only individual or team feedback. Teams comprised of members who receive neither individual nor team feedback during training will exhibit the least individual declarative knowledge, coherence of knowledge structures, and individual skills by the end of training.

Influence of Level of Feedback on Team Training Outcomes

Feedback is also hypothesized to influence team training outcomes. A key characteristic of feedback important to the acquisition of team-related competencies is the focus of the feedback. Feedback that is at different levels of focus will differentially affect team training outcomes.

H12: Level of focus of feedback present during training will influence team training outcomes.

It is clear that team feedback is important for the acquisition of team knowledge and skills because it stimulates regulation around team outcomes and because it provides information important for diagnosing team processes and performance. This in turn, should influence the development of team declarative knowledge.

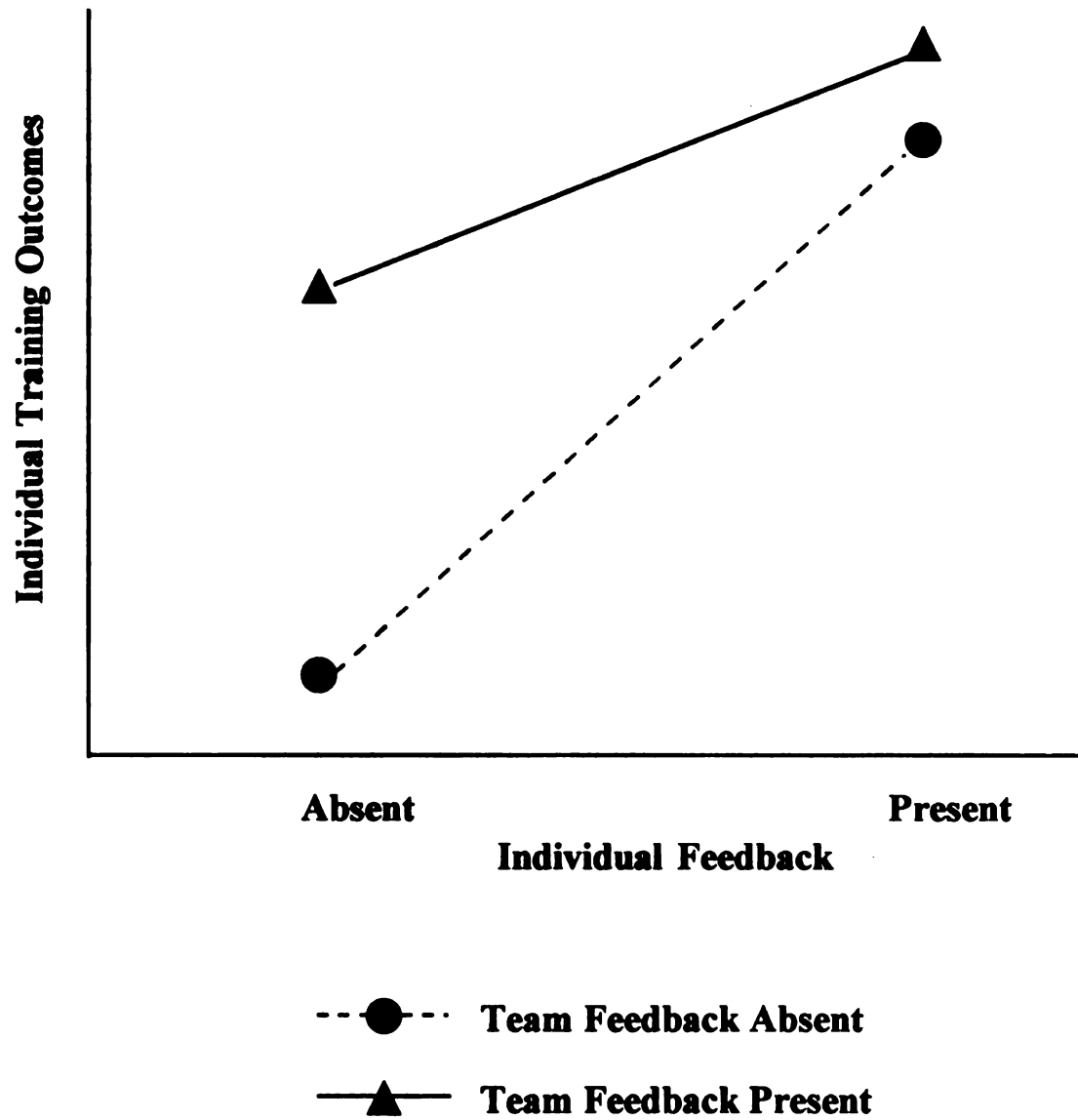


Figure 20. Interaction Effect of Presence of Individual and Team Feedback on Individual Training Outcomes

H12a: Teams comprised of members who receive team feedback during training will exhibit more team declarative knowledge by the end of training than teams comprised of members who do not receive team feedback during training.

Consistent with earlier discussion, individual and team feedback are expected to interact to affect the amount of team declarative knowledge present by the end of training. This interaction is presented in Figure 21.

H12b: Teams comprised of members who receive both individual and team feedback during training will exhibit more team declarative knowledge by the end of training than teams comprised of members who receive only individual or team feedback. Teams comprised of members who receive neither individual nor team feedback during training will exhibit the least team declarative knowledge by the end of training.

In addition to effects on team declarative knowledge, team feedback is hypothesized to influence the development of shared knowledge structures and team skill. Without feedback, the development of shared knowledge structures and team skill would be slow and error-prone.

H12c: Teams comprised of members receiving team feedback during training will exhibit more sharedness of knowledge structure and team skill by the end of training than teams comprised of members who do not receive team feedback during training.

Team feedback will also interact with individual feedback to affect the development of shared knowledge structures and team skill. When both individual and team feedback are present, sharedness and skill will be the greatest.

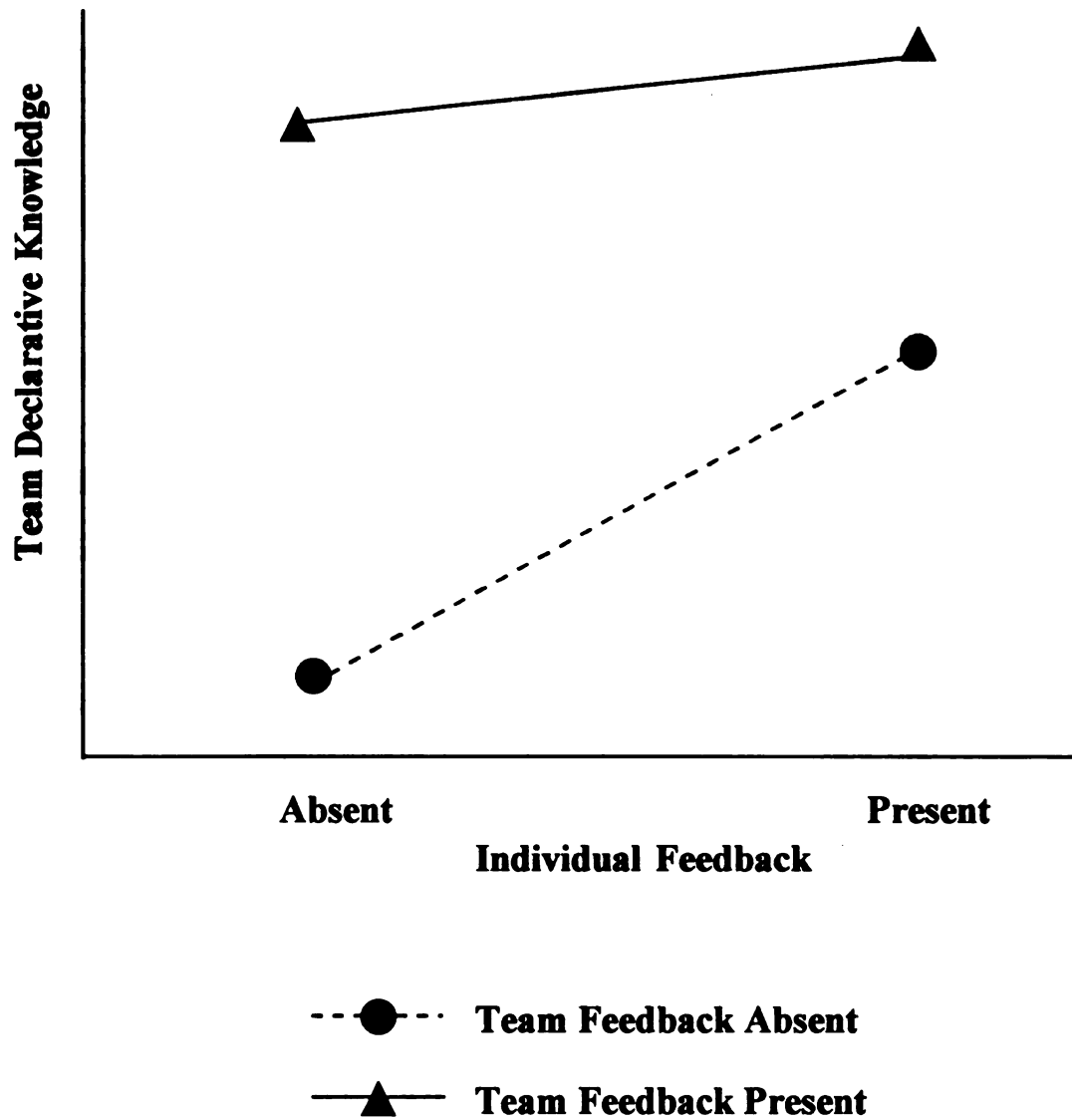


Figure 21. Interaction Effect of Presence of Individual and Team Feedback on Team Declarative Knowledge

H12d: Teams comprised of members receiving both individual and team feedback during training will exhibit more sharedness of knowledge structure and team skill than teams comprised of members receiving only individual or team feedback. Teams comprised of members receiving neither individual nor team feedback during training will exhibit the least in team sharedness and team skill by the end of training.

Implications for Training in Team Contexts

The conceptual model presented builds on research and theory on individual training. It highlights three important outcomes of training, including knowledge, skills, and affect/attitudes, and then applies this individual level research to training in team contexts. In addition to emphasizing individual outcomes, the model highlights the importance of team-oriented outcomes of training.

Additionally, the conceptual model emphasizes the important role that individual self-regulatory processes play in the development of training outcomes important in the team training context. This provides a deeper understanding of the processes related to the acquisition of individual and team skills in a complex task environment. This understanding can also provide a framework for developing training systems designed to impact these regulatory processes in a positive manner.

For example, the model separates the effects of SEFF and PTEFF on learning and performance adaptability. The implication of this separation is that a training system must not only foster the development of individual confidence and skills, but also team-oriented confidence and skills. This has important implications for the types of instructional and training events designed in a training system to be provided to members of teams.

Although the model is based in part on previous empirical research, many parts of the model remain untested. The purpose of the current study is to empirically test key processes and mechanisms described by the conceptual model. In particular, the role of feedback, goals, and efficacy on training outcomes and adaptability of performance in a team context will be investigated.

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**THE INFLUENCES OF SELF-REGULATORY PROCESSES ON
LEARNING AND PERFORMANCE IN A TEAM TRAINING CONTEXT**

VOLUME II

By

Stanley Morris Gully

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

DOCTOR OF PHILOSOPHY

Department of Psychology

1997

METHOD

Participants

The sample included a total of 285 undergraduate management, psychology, and communication students at a large midwestern university. Participants spent approximately five hours over two days performing a three-person team-based complex radar tracking task. Participants received class credit and opportunities to win awards for individual and team performance. Participants were randomly assigned to teams and positions within teams. There were a total of 95 teams. All participants were treated in accordance with the ethical standards of the American Psychological Association (American Psychological Association, 1992). The full sample included 112 males and 173 females. Six teams were eliminated from the study because they failed to follow experimental instructions. There were no apparent differences between the characteristics of the six teams eliminated and the rest of the sample (e.g., sex, age, individual differences). The drop rate was very similar across the four experimental conditions in the study (2, 1, 1, 2, respectively), yielding a usable sample of 89 teams with 267 participants.

The choice of sample size was based on a power analysis and review of typical sample sizes in research involving groups or teams. A meta-analysis by Freeberg and Rock (1987) of studies involving input, mediating, and output variables in team research found the average sample size was 39 (cited in National Research Council, 1994). Similarly, the

average sample size of group level studies in a meta-analysis of cohesion and performance was found to be 35 by Gully, Whitney, and Devine (1995). A power analysis indicates that typical studies have a power of only .14 to detect small effect sizes and .61 to detect moderate effect sizes (see Appendix A). A sample size of 40 or less has sufficient power for detecting large effect sizes only (power = .95). The power analysis for the current study suggested that approximately 90 teams would be required to maintain a power of .80 to detect moderate to large effect sizes.

Design

The basic design was a 2 (individual feedback) X 2 (team feedback) X 6 (trial) completely crossed factorial design conducted in an experimental setting. Individual and team feedback (present/absent) were between variables and trial (five training/one adaptability) was a within variable. Presence and absence of feedback at different levels were chosen as manipulations because, as portrayed in Figure 5, they would be expected to impact the self-regulatory and learning process of individuals in teams. Alternative manipulations, like assigning goals or altering efficacy perceptions, could have been employed. Given the theory proposed, any leveraging of the self-regulatory process should yield strong effects on learning and performance adaptability.

Feedback manipulations were selected over goal manipulations because of the following issues. First, it is clear from the literature that assigned goals may have different effects from self-set goals. However, assigned goals have been shown to be less consistently useful on complex tasks, and team environments are often characterized by high levels of task complexity. Second, although there is a limited amount of research on the impact of assigned goals on teams, even less is known about the determinants

and impacts of self-set goals on team learning and performance. Using assigned goals as manipulations would preclude testing of hypotheses relevant to self-set goals.

Feedback manipulations were also chosen over efficacy manipulations for the following reasons. First, altering efficacy perceptions would require deception. Participants might negatively respond to the deception manipulations if they were too transparent. It is potentially problematic to alter efficacy perceptions without making the manipulations transparent. Second, the most likely form of efficacy manipulation would involve the provision of some form of false feedback. Because the interest was in the patterns of findings relative to the entire regulatory process given true learning opportunities, it was important to minimize the influence of false information. Additionally, the provision of false feedback would confound the effects of fake feedback with the effects of efficacy.

The purpose of the study was to investigate whether key theoretical linkages between the constructs of interest would emerge as expected. Feedback was chosen as a primary manipulation of the self-regulatory process because it has been shown to have strong impacts on the self-regulatory process at the individual level (Taylor et al., 1984) and limited research has investigated its effects on learning in a team environment. The use of manipulations of feedback level would allow investigations of feedback effects on self-set goals, and the impact of self-set goals on learning and performance adaptability. The choice of level of feedback manipulations would also avoid the necessity of providing false information to manipulate efficacy perceptions, which could potentially confound the effects of feedback accuracy with the effects of efficacy perceptions.

Five sets of mediating or dependent variables were measured. The first set included measures of efficacy for individual and team performance. The second set focused on measures of goal setting and goal commitment for individual goals (INDGLS) and team goals (TMGLS). The third set involved measures of learning and knowledge structure for individual and team competencies. The fourth set included measures of task performance for individual members and teams. The final set included measures related to affect and motivation at the end of training, including cohesion, self-efficacy (SEFF), and satisfaction. See Table 1 for a summary of all independent variables and measures included in the study.

The study was conducted in an experimental setting for several reasons. First, the purpose of the study was to determine if feedback level could influence self-regulatory processes which are important for learning and performance in a team context. The theory underlying the study is relatively untested, so it is reasonable to investigate whether or not the foundations of the theory are tenable prior to attempting its validation in a field setting (Driskell & Salas, 1992; Mook, 1983). Second, the laboratory is high in fidelity to field settings because the focus of the study was on learning and skill acquisition for a novel, highly interdependent, team task. Learning of such a task can be effectively modelled in the laboratory, because skill acquisition and learning for such tasks can occur in both field and laboratory settings. Third, control of important dimensions of feedback and other contextual cues is not likely to occur in a field context. Control of feedback and contextual cues is critical to being able to draw a strong inference of causation and for providing a test of the hypotheses of interest.

Table 1.**Independent, Mediating, and Dependent Variables of Interest****Manipulated Independent Variables****Individual feedback (present/absent)****Team feedback (present/absent)****Team experience (five training trials, one adaptability task)****Mediating and Dependent Variables of Interest****Self-efficacy (at end of each training trial, and at the end of days one and two)****Team-efficacy (at end of each training trial, and at the end of days one and two)****Goal level for individual goals (at beginning of each trial, except the first trial and adaptability task)****Goal level for team goals (at beginning of each trial, except the first trial and adaptability task)****Individual and team satisfaction at end of day one and day two, prior to the adaptability task****Cohesion at end of day one and day two, prior to the adaptability task****Pathfinder ratings (including team concepts) at end of day two, prior to the adaptability task****Scores on knowledge test (including team concepts) at end of day two, prior to the adaptability task****TAS training measures - score, accuracy, penalty circle intrusions, etc. (individual and team measures obtained from each training trial)****TAS performance adaptability measures - score, accuracy, penalty circle intrusions, etc. (individual and team measures obtained on adaptability)****Additional Measures and Potential Covariates****Demographics (age, sex, school level, etc.)****Ability (Wonderlic, self-reported grade point)****Goal orientation****Individualism/Collectivism****Goal commitment to individual goals (at beginning of each trial, except the first)****Goal commitment to team goals (at beginning of each trial, except the first)****Role clarity and interpositional certainty at end of day one and day two, prior to the adaptability task****Individual and team task frustration at end of day one and day two, prior to the adaptability task****Attendance at second day of training****Retrospective task motivation (at end of experiment)****Task withdrawal (at end of experiment)**

Task Description

Three person teams performed the Tactical Action Simulation (TAS) which is a configured set of scripts based on a revised version of the TANDEM system known as TEAMS/TANDEM. (Dwyer, Hall, Volpe, Cannon-Bowers, & Salas, 1992; Kozlowski & Gully, 1996). The Team Event-based Addaptive Multilevel Simulation/Tactical Navy Decision Making system (TEAMS/TANDEM) is a radar tracking, identification, and decision making task developed and distributed by the Human Factors Division of the Naval Air Warfare Center (NAWC). TEAMS/TANDEM can be configured to run as an individual or team simulation. It runs on IBM compatible, personal computer stations equipped with color monitors, keyboards, network cards, and three button mice.

Participants in the study used a mouse to access pull-down menus, gathered information about contacts traversing the simulated radar screen, and made four decisions about each contact (see Table 2; see Figures 22 and 23). Participants determined the contacts' Type, Class, and Intent based on four cues for each decision. They then decided what action to take regarding each of the contacts. During each trial, participants acted on as many contacts as possible. Participants had to balance information gathering and decision-making for a given contact against the placement and movement of the other contacts on the screen.

The TAS scripts for TEAMS/TANDEM possess a reasonable degree of task fidelity, allow for multiple decisions to unfold naturally, incorporate multiple and differentiated decision makers, and the scripts provide a dynamic task environment. The simulation is designed to emulate the workload and chaos in real-world decision-making situations (Dwyer et al., 1992), and it has been successfully used in a variety of research

Table 2.

Decisions and Information Values

TYPE DECISION			
Information	Submarine	Surface	Air
Altitude/Depth	< 0 m	0 m	> 0 m
Climb/ Dive_Rate	< 0 m	0 m	> 0 m
Signal Strength	Low	High	Medium
Communication Time	81 - 120 s	41 - 80 s	0-40 s

CLASS DECISION			
Information	Civilian	Unknown	Military
Maneuvering Pattern	Code Foxtrot	Code Echo	Code Delta
Intelligence	Private	Stage	Platform
Direction of Origin	Blue Lagoon	Black River	Red Sea
Initial Range	0 - 20.9 nm	21 - 100 nm	> 100 nm

INTENT DECISION			
Information	Peaceful	Unknown	Hostile
Missile Lock	Clean	Possible	Locked
Countermeasures	None	Sporadic	Jamming
Response	Given	Inaudible	No Response
Electronic Warfare	None	Undetected	Detected

RULES FOR ENGAGE DECISION

The Engage decision ranges from Clear to Shoot. The least threatening contacts should be Cleared. Minimal threat contacts should be Monitored. Moderate threat contacts should be Warned. High threat contacts should be Locked-On with radar for weapons systems. The most threatening contacts should be Shot.

Regarding Type:

Surface contacts are least threatening because they are highly visible and easy to defend against.

Submarine contacts are moderately threatening because they are stealthy and difficult to defend against.

Air contacts are most threatening because of their high speed and because they are hard to defend against.

Table 2 (Cont'd).

Decisions and Information ValuesRegarding Class:

Civilian contacts are low in threat, because they are unlikely to attack. They are not always zero in threat because some contacts may occasionally be disguised as Civilian craft and they may be hard to defend against.

Military contacts are high in threat, because they are capable of attack. Military contacts are not always high in threat because they may be easy to defend against or they may be peacefuls.

Regarding Intent:

Peaceful contacts are low in threat. They are not always zero in threat because they may be disguised as peacefuls and still be dangerous.

Hostile contacts are high in threat. They are not always high in threat because they may actually be peacefuls mistakenly identified as Hostile.

<u>Type of Contact</u>	<u>Engage</u>
Air-Military-Hostile	Shoot
Air-Military-Peaceful	Lock-On
Air-Civilian-Hostile	Warn
Air-Civilian-Peaceful	Monitor
Sub-Military-Hostile	Shoot
Sub-Military-Peaceful	Warn
Sub-Civilian-Hostile	Warn
Sub-Civilian-Peaceful	Clear
Surface-Military-Hostile	Lock-On
Surface-Military-Peaceful	Warn
Surface-Civilian-Hostile	Monitor
Surface-Civilian-Peaceful	Clear

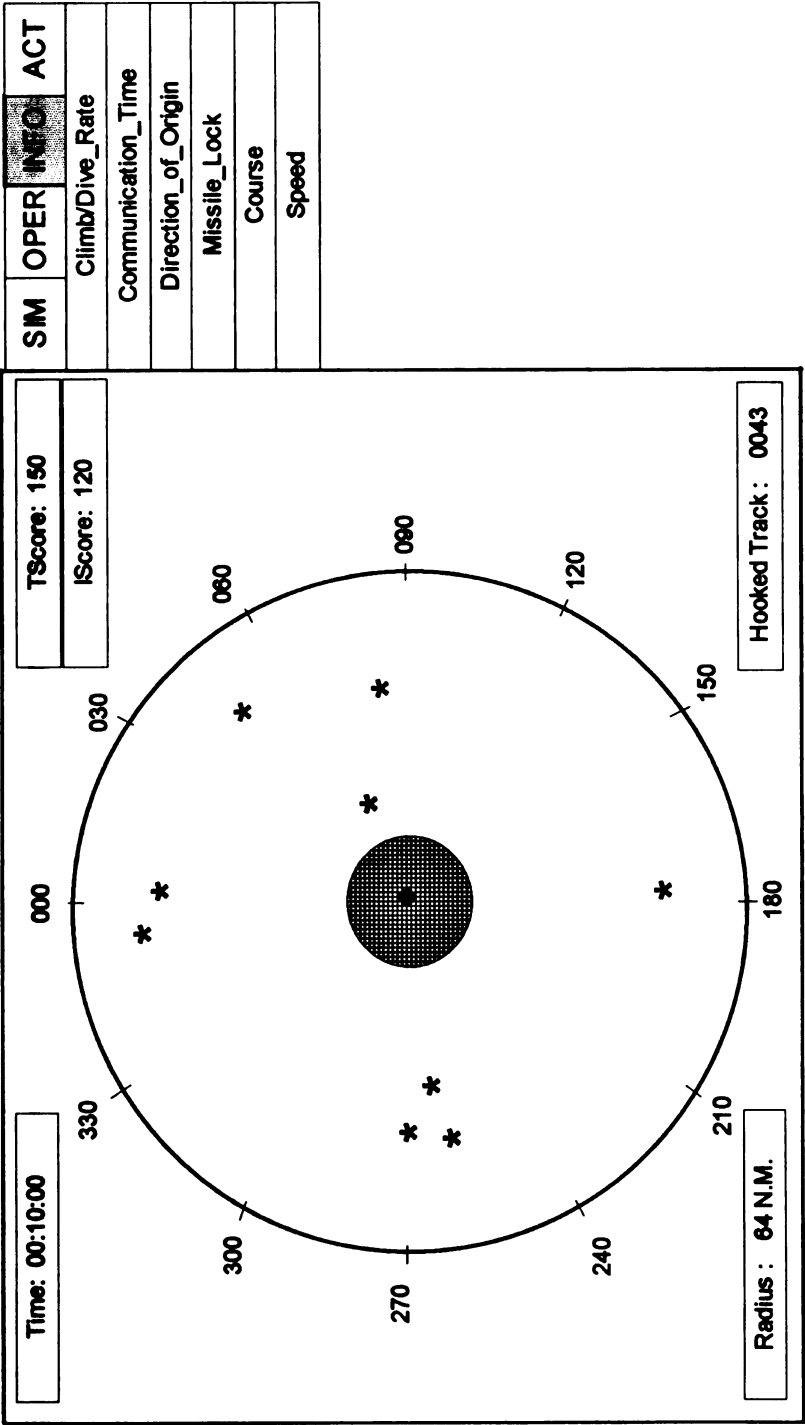


Figure 22. Display Console for the Tactical Action Simulation

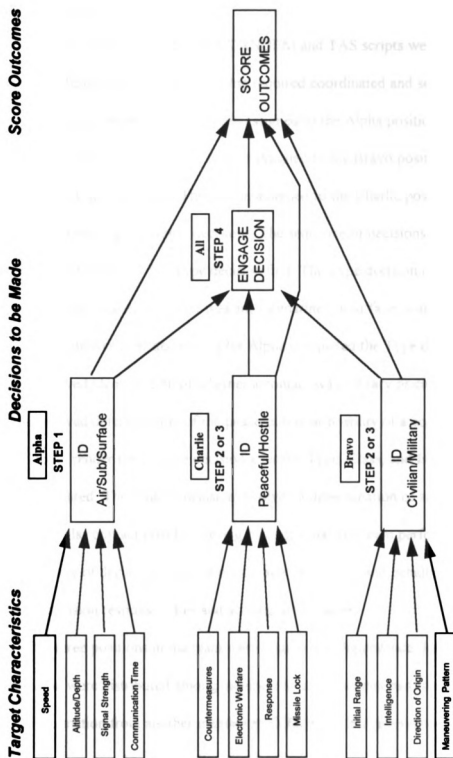


Figure 23. Contact Characteristics, Decisions, Position Responsibilities, and Outcomes

efforts (Baker, 1991; Dwyer et al., 1992; Ford et al., 1995; Kozlowski et al., 1995; Kozlowski & Gully, 1996).

For the current study, TEAMS/TANDEM and TAS scripts were configured to yield three different well-defined roles that required coordinated and sequenced behaviors on the part of team members. The person assigned to the Alpha position was responsible for making the Type decisions. The person assigned to the Bravo position was responsible for making the Class decisions. The person assigned to the Charlie position was responsible for making the Intent decisions. The sequence of decisions was such that Alpha had to render his or her Type decision first. The Type decision involved a determination of whether a contact was air, submarine, or surface in nature. Bravo and Charlie had to deliver their decisions after Alpha completed the Type decision. The Class decision involved identification of whether a contact was military or civilian. The Intent decision involved determination of the peacefulness or hostility of a contact. Any team member could render the Engage decision after the Type, Class, and Intent decisions all had been rendered. The Engage decision involved a determination of an appropriate action given a particular contact profile. Scoring for individual and team performance was based on the accuracy of decisions, number of contacts processed, and penalty intrusions. Table 3 presents decision responsibilities and scoring of decisions.

The three positions in the team were high in interdependence. Information cues for each decision were distributed among members so each member had to obtain at least one piece of information from another member to fulfill his or her role responsibilities. Thus, members were required to constantly communicate and share information with each other in an accurate and timely fashion, preferably using a protocol which specified an efficient

Table 3.

Decisions, Positions, Scoring

TRAINING SCENARIO

	TYPE	CLASS	INTENT	ENGAGE
Decision to be Made	Air Surface Submarine	Civilian Military	Peaceful Hostile	Clear Monitor Warn Lock-On Shoot
Individual Score	+50 points correct -50 points incorrect	+50 points correct -50 points incorrect	+50 points correct -50 points incorrect	+100 pts correct -50 pts for each one off incorrect
Team Score	+30 points correct -30 points incorrect	+30 points correct -30 points incorrect	+30 points correct -30 points incorrect	+60 pts correct -30 pts for each one off incorrect
Position	Alpha	Bravo	Charlie	Any

Note: Each defensive perimeter intrusion resulted in a deduction of 50 points at the end of the scenario for both the individual and team score.

Table 3 (Cont'd).

ADAPTABILITY SCENARIO

	TYPE	CLASS	INTENT	ENGAGE
Decision to be Made	Air Surface Submarine	Civilian Military	Peaceful Hostile	Clear Monitor Warn Lock-On Shoot
Individual Score	+50 points correct -50 points incorrect	+50 points correct -50 points incorrect	+50 points correct -50 points incorrect	+200 pts correct -100 pts for each one off incorrect
Team Score	+30 points correct -30 points incorrect	+30 points correct -30 points incorrect	+30 points correct -30 points incorrect	+120 pts correct -60 pts for each one off incorrect
Position	Alpha	Bravo	Charlie	Any

Note: Each defensive perimeter intrusion resulted in a deduction of 150 points at the end of the scenario for both the individual and team score.

method of communication (e.g., ordering of contact track numbers, position designations, etc.). Additionally, the decision sequence and selection of contacts for action required extensive coordination among the members for the team to be effective in processing contacts and preventing intrusions into the defensive perimeter.

A single inner defensive perimeter at 10 nautical miles (penalty circle) existed. Intrusion into the defensive perimeter resulted in a deduction of 50 points from both individual and team scores during training. The presence of a defensive perimeter made it important for members to develop team strategies and coordination skills to deal with multiple contacts which threatened to penetrate it. Tradeoffs in attention to various contacts could result in a breakdown of team processes and a high number of perimeter intrusions unless actions were coordinated and well synchronized. The cost of perimeter intrusions was increased to 150 points for the adaptability task.

Feedback. The influence of feedback level on individual learning, efficacy, and goals is an important part of the current study. The scoring and feedback systems of TAS are highly configurable. Some teams received both individual and team outcome feedback, some received either team or individual outcome feedback but not both, and some received neither form of outcome feedback. After the initial trial, instructions appropriate to the feedback condition were presented (see Appendix B) and only feedback consistent with the training condition was provided. During training all teams had complete access to information about the accuracy of decisions about a given contact as the Engage decision was made. This provided diagnostic feedback to all teams, including those not receiving individual or team outcome feedback. This eliminated unequal opportunities for learning as an alternative explanation for obtained findings. The presence of diagnostic feedback

reduced the effect of the feedback manipulations by equating all groups on access to feedback crucial for performance.

Awards. Awards were provided to participants on the basis of their individual performance, their team performance, and how much they learned. The awards were to ensure participants were interested in performing well on the task. First and second place team prizes were given to the teams which performed best on the adaptability task, given their respective feedback conditions. The first place team prize was \$45, and the second place team prize was \$30. There were a total of four first place and four second place team prizes, one for each of the four feedback conditions. A \$45 team prize translates to \$15 per team member and a \$30 team prize translates to \$10 per team member.

First and second place individual prizes were also given to those individuals who performed best on the adaptability task, given their respective positions and feedback conditions. First place individual prizes were \$10, and second place individual prizes were \$7. There were a total of twelve first place and twelve second place individual prizes (one of each for Alpha, Bravo, and Charlie for each of the four feedback conditions). The team awards were thirty percent larger than individual awards because achievement of team goals required more coordination, learning, and effort than achievement of INDGLS. Additionally, the purpose of the study was to investigate how orientation toward or away from TMGLS affected learning of team skills and team performance. Thus, TMGLS were made salient to individuals learning the task. This potentially reduced the effectiveness of the level of feedback manipulations by orienting team members toward TMGLS. Additionally, four \$5 prizes for accurately answering questions about the task were

awarded to participants to encourage learning and mastery of the task and to promote accurate responses to knowledge measures.

Training and performance adaptability task. Participants were informed that they would progress through several practice training trials, none of which would count toward the awards being given. They were also told that they would have an opportunity to show what they had learned on a more difficult task at the end of the second day. The first training trial was a familiarization session designed to ensure that all participants understood how to perform basic aspects of the task. The second through fifth trials were comprised of four more training trials, each with the appropriate feedback manipulations. Each training trial lasted 15 minutes with 45 contacts available for processing. No team on any of the trials completed all 45 contacts. The training trials were not used to determine award distribution. Thus, scores obtained during training were primarily important for providing feedback to the participants performing the task. Opportunities to practice all skills required for the final adaptability task were provided, and all materials relevant to learning the task were available throughout the training trials.

The adaptability task was designed to substantially increase the workload (Baker, 1991), complexity (Wood, 1986), and criticality of task performance. Workload was increased by adding 30 percent more contacts for a total of 60 contacts, and by telling participants points would be deducted for contacts for which no actions were taken. None of the teams were likely to complete processing of all contacts in the time allotted, so the presence of 60 contacts was sufficient to create a high workload situation. The complexity of the task was increased by having many contacts suddenly appear on the screen and move quickly toward the defensive perimeter. This aspect of the task required more

sophisticated team strategies for balancing tradeoffs in the processing of contacts.

Additionally, the task was made more complex by removing any access to feedback, outcome or diagnostic, during the performance adaptability trial. The criticality of the task was changed by increasing the importance of the Engage decision. The scores for the Engage decision were worth more if made correctly but they cost more if made incorrectly. The importance of task performance was also increased because the score for the final adaptability task counted for award distribution. Finally, the adaptability task was performed without any access to written materials which were available during training.

Training manuals. All participants had access to three manuals during training which provided all information necessary to perform TAS effectively. The first overview manual provided basic task information. The second position manual described how each of the positions were to be performed and provided the information necessary to fulfill task requirements for specific roles in the team. Each team member received the position manual relevant to his or her specific position (Alpha, Bravo, Charlie). The third team manual described team processes that were important for effective team performance (e.g., communication, coordination, and cooperation). The team skills described in the team manual were derived from previous research identifying team skills that differentiated effective and ineffective teams (McIntyre & Salas, 1995; Morgan et al., 1986; Swezey & Salas, 1992; Zander, 1994).

Pilot Study

A pilot study involving twenty-five teams was conducted to ensure: (1) the simulation had no unforeseen adverse effects on participants; (2) participant attitudes, perceptions, learning, and performance could be reliably measured; (3) feedback level and

manipulations would have some effect on learning and performance; (4) instructions for the study were clear and not likely to unintentionally bias participants; (5) scoring systems for individual and team performance were reasonable; and (6) the adaptability task was perceived to be higher in workload, complexity, and criticality.

Participants provided responses to a questionnaire about their experiences in the pilot study. The results indicated that the instructions for the task had to be clarified and the number of measures included in the study had to be reduced to the final set listed in Table 1. Factor analyses and reliability analyses were performed on the responses provided by the participants in the pilot study. Although the sample size was relatively small in the pilot study, initial factor patterns and reliabilities suggested the measures employed in the study were valid and reliable. The effect of the feedback manipulations on performance were analyzed using ANOVAs. Although group means were not significantly different due to the small sample size, the initial findings suggested that the feedback manipulations were effective for influencing learning and performance. Participants were asked about clarity of research instructions and whether or not instructions created any form of experimenter demand effect. They also answered open-ended questions regarding their beliefs about the topics of interest in the research being conducted. Participants in the pilot study stated that they did not know what was expected, nor did they know the specific purpose of the study. Participants also described a basic understanding of scoring systems and how actions were related to scoring outcomes at both the individual and team level. Finally, ratings in the pilot study indicated that participants felt the adaptability task was substantially higher in workload, complexity, difficulty, and criticality. The information from the pilot study was used to revise procedures and measures for the full study.

Procedure

Research assistants. Nine different research assistants conducted the data collection with the assistance of the experimenter. All research assistants were unaware of the specific hypotheses being tested, and teams were randomly assigned for data collection. Each assistant was given a detailed protocol which explained experimental procedures and which provided specific instructions to be read aloud to participants. Procedures were highly standardized, and each assistant was trained for a minimum of two hours in the proper administration of the experiment. Post hoc analyses indicated no significant differences among teams in their knowledge and performance as a function of research assistants.

Day one. Upon arrival, participants were randomly assigned to teams and positions, after which they completed an informed consent form (Appendix C). Next, they responded to measures of ability and other individual differences (Appendix D). Participants then had an opportunity to read the training manuals for TAS for five minutes, after which they were presented with a five minute demonstration of the task. Once participants were familiar with the basic aspects of the task, participants had fifteen minutes to explore the task as a team. This was the first training trial. It was a familiarization trial used for the development of basic task knowledge and to establish a baseline of performance. After the first trial, participants responded to questionnaires measuring self- and team-efficacy, and goal setting and goal commitment at the individual and team levels. Upon completion of the questionnaires, participants had an eight minute block to read material about the task and speak with each other. Participants then received information describing how to attend to and interpret the feedback available (individual,

team, neither, both) (see Appendix B). All participants learned how to interpret the diagnostic feedback which was available to all teams. The diagnostic feedback equated teams on learning opportunities. Next, participants performed the task as a team in the second training trial. At the end of the second training session, measures of efficacy and goals were collected. Upon completion of the measures, participants had a second eight minute block to read material about the task, followed by the third training session. After the third training session was completed, participants responded to measures of attitudes and affect. The affective measures included efficacy, satisfaction, and cohesion. See Table 4 for a summary of the procedures for days one and two.

Day two. Upon arrival on the second day, participants were presented with information describing how to attend to and interpret the feedback available (individual, team, neither, both) during the training sessions. Participants then had five minutes to refamiliarize themselves with the task as a team, followed by measures of efficacy perceptions, goal setting, and goal commitment. Next, participants had an eight minute block to read material about the task, followed by the fourth training session which lasted fifteen minutes. Measures of efficacy perceptions, goal setting, and goal commitment were collected, followed by an eight minute block to read material about the task. Participants then had a final fifteen minute training trial, after which measures of learning and affect were collected. The learning measures included a multiple choice knowledge test used to measure declarative knowledge of individual and team skills and Pathfinder ratings used to measure structural knowledge (Schvaneveldt, 1990). Participants were then presented with task instructions for the final adaptability task, detailing similarities and differences between the training trials and the final task (see Appendix E). Participants completed

Table 4.**Procedures****Day 1:**

1. Collection of individual difference measures (25 min)
2. Read manual for overview of task (5 min)
3. Demonstration of task (5 min)
4. Fifteen minute familiarization training trial (15 min)
5. Measures of self efficacy and team efficacy (3 min)
6. Measures of goal setting (individual and team) and goal commitment (individual and team) (3 min)
7. Eight minute block to read and learn about task (8 min)
8. Information on how to interpret feedback available (3 min)
9. Second training trial (15 mins)
10. Measures of self efficacy and team efficacy (3 min)
11. Measures of goal setting (individual and team) and goal commitment (individual and team) (3 min)
12. Eight minute block to read and learn about task (8 min)
13. Third training trial (15 mins)
14. Training outcome measures (25 min):
 - a. Measures of self efficacy and team efficacy
 - b. Role clarity (individual/IPU)
 - c. Satisfaction (individual/team)
 - d. Frustration (individual/team)
 - e. Cohesion
 - f. Attendance at following day session
15. Scheduling for next day (2 min)

Day 2:

1. Day 2 instructions plus information on how to interpret feedback available (5 min)
2. Five minute refamiliarization trial (5 min)
3. Measures of self efficacy and team efficacy (3 min)
4. Measures of goal setting (individual and team) and goal commitment (individual and team) (3 min)
5. Eight minute block to read and learn about task (8 min)
6. Fourth training trial (15 mins)
7. Measures of self efficacy and team efficacy (3 min)
8. Measures of goal setting (individual and team) and goal commitment (individual and team) (3 min)
9. Eight minute block to read and learn about task (8 min)
10. Fifth training trial (15 mins)

Table 4 (Cont'd).

11. Training outcome measures (25 mins):
 - a. Measures of self efficacy and team efficacy
 - b. Role clarity (individual/IPU)
 - c. Satisfaction (individual/team)
 - d. Frustration (individual/team)
 - e. Cohesion
 - f. Declarative knowledge (individual/team)
 - g. Pathfinder (individual/team) (10 min)
12. Two minute block for instructions for adaptability task (2 min)
13. Measures of goal commitment (individual and team) (3 min)
14. Three minute block to read and learn about task (3 min)
15. Adaptability task (15 mins)
16. Outcome measures (5 min):
 - a. Task motivation (individual/team) - retrospective
 - b. Task withdrawal
17. Debrief (5 min)

Total time Day 1: Two hours and forty minutes (160 minutes)

Total Time Day 2: Two hours and twenty minutes (140 minutes)

Total time of participant involvement: Five hours (300 minutes)

Total time in training, including reading, demonstrations, and on-task: Two hours and twenty-five minutes (145 minutes)

Total time in training on-task: One hour and twenty minutes (80 minutes)

Total time on-task including adaptability task: One hour and thirty-five minutes (95 minutes)

measures of goal commitment for “do your best goals” on the adaptability task, followed by a final three minute block for reading, strategizing, and planning. Participants then performed the adaptability task as a team for fifteen minutes. Rewards were provided based upon individual and team performance on the adaptability task. At the end of the study, measures of task withdrawal and motivation were collected. Participants were debriefed, their questions were answered, and they were thanked for their participation. See Appendix F for the debrief form. Table 4 summarizes the procedures used in the experiment.

Measures

Efficacy perceptions. Measures of SEFF and personal team-efficacy (PTEFF) were collected using instruments adapted from Ford et al., (1995), Kozlowski et al., (1995), and Phillips and Gully (in press) for the current study (see Appendix D). These items were written in five point Likert scale format, asking respondents to indicate how capable they felt as individuals and as a team, their self confidence on the task and their confidence in the team, and their belief in their ability as individuals and as a team to respond to task changes. There were a total of six items for each scale.

Efficacy perceptions were collected following each training trial; at the end of day one; at the beginning of day two; and at the end of training on day two prior to the performance adaptability task. There were a total of six measurements collected. The coefficient alphas for SEFF across the six measurements ranged from .92 to .94 (6 items), indicating high levels of internal consistency reliability. The coefficient alphas for PTEFF across the six measurements ranged from .92 to .95 (6 items). A common factors analysis using an oblique oblimin rotation (Ford, MacCallum, & Tait, 1986; Tinsley & Tinsley,

1987) yielded a two factor structure for each measurement period, corresponding to the constructs of SEFF and PTEFF. For the first four measurements, each item had its largest loading on the construct for which it was intended to measure, and the loadings on each factor were above .70. For the last two measurements, the two factor structure was still readily apparent, but a couple of the items had higher loadings on the efficacy construct for which they were not written. Also, the cross-loadings of items on the two factors increased over measurement periods. This indicated that SEFF and PTEFF became increasingly unidimensional over time. However, the overall pattern of results showed a strong two factor structure that replicated the intended constructs to be measured. Complete factor analytic results and factor structure matrices by measurement period are not included due to length considerations, but they are available from the author. Based on the reliability analysis and factor analytic results, scale scores were computed from the six items comprising each of the two scales. The correlation between SEFF and PTEFF increased at every measurement period (.53, .60, .69, .71, .74, .81, respectively).

Because the individuals were nested in teams, there are potential problems with reliabilities and factor analyses of scales at the individual level, if one ignores the team level effects (Sirotnik, 1980). Factor analyses and reliability analyses were conducted at the team level using mean scores for items across the team members. A clear two-factor structure emerged at each time period, and the coefficient alphas were all high (above .92). The correlations between SEFF and PTEFF at each measurement were slightly higher at the team level than the correlations computed at the individual level (.62, .73, .77, .77, .85, .87, respectively). Factor analyses and reliability analyses were also

performed by position, so that only one member from each team was represented in the analyses. Results were consistent with those obtained at the individual and team levels.

Goals. Participants provided self-set goals for individual and team performance following measurements of efficacy, and prior to the start of the eight minute blocks for learning material and the fifteen minute training sessions. There were three different goal measures collected for both INDGLS and TMGLS. The first item asked participants to set a specific goal in terms of a score to be attained. The second item asked participants to set a specific goal for attainment of a percentage of total points possible. The final item asked participants to rate their goal level on a scale from extremely low to extremely high. The items used to measure self-set goals were consistent with methods of measurement used in previous goal setting studies. Each of the goal items had very different means and variances, so they were standardized prior to combining them into a single goal measure for either INDGLS or TMGLS. The standardized alpha for INDGLS across the four measurements ranged from .63 to .68 (3 items). The standardized alpha for TMGLS across the four measurements ranged from .51 to .63 (3 items). The correlations between INDGLS and TMGLS were strong across all measurements (.71, .73, .72, .70). Reliability results were similar using item means at the team level and when analyzed by position. Correlations between INDGLS and TMGLS were slightly higher when computed at the team level.

Declarative knowledge. Assessments of individual and team declarative task knowledge were obtained using a total of twenty-five multiple choice items administered at the end of day two, prior to the performance of the adaptability task. Each item had a single correct answer, and items were scored dichotomously (right/wrong). Some of the

items for assessing individual declarative knowledge were adapted from previous studies demonstrating their impact on individual performance (e.g., Kozlowski et al., 1995). Additional items were created from manuals used to instruct participants in specific task skills. These items related to knowledge of information and tasks for a particular position. Items for assessing team declarative knowledge were drawn directly from manuals used to train members in team skills. The content of the items included definitional knowledge of team skills, specification of how member behaviors related to those of other members, descriptions of member assignments and positions, and understanding of proper communications protocols. The items measuring individual and team declarative knowledge were highly content valid because they were based on previous research and drawn directly from the manuals used to instruct participants. Common factors analyses indicated strong support for two factors corresponding to individual declarative knowledge and team declarative knowledge. Some of the items did not have their highest loadings on the constructs for which they were intended to measure, but the loadings of the items onto the primary constructs of interest tended to be high. A preliminary set of explorations of the declarative knowledge measures and their relationships with other variables indicated that patterns of correlations and reliabilities changed very little when either eliminating the potentially problematic items or reassigning them to different constructs. Based on theory and the obtained reliability and factor analytic results, a decision was made to retain all items and assign them to the constructs they were intended to measure. The final measures of reliability for the dichotomous items comprising individual and team declarative knowledge were .60 (8 items) and .65 (17 items), respectively. Individual declarative knowledge and team declarative knowledge were

correlated .46. The factor structure was slightly less clear at the team level, but generally consistent with that found at the individual level. The reliabilities at the team level using item means were .68 and .64 for individual and team declarative knowledge, respectively. The two factor structure when analyzed by position was very similar to that obtained using individual measures. Based on these findings, the content of the items, and the reliability analyses, scale scores were computed for individual and team declarative knowledge using the items which were written to measure these aspects of knowledge.

Knowledge structure. Assessments of knowledge structure were obtained following the completion of training trials at the end of day two, prior to the performance of the adaptability task. Ratings of relatedness among key actions, positions, and informational sources were obtained using Pathfinder software (Schvaneveldt, 1990). These ratings indicate strength of relationships between concepts and can be used to assess structure of knowledge for the concepts of interest. Previous research has demonstrated high levels of reliability and validity for ratings of relatedness (Kozlowski et al., 1995; Kraiger, 1993; Schvaneveldt, 1990).

Concepts were selected to represent task features, actions, information, and positions that were linked to the strategies and behaviors needed to effectively perform complex aspects of the task (see Appendix D). Indices of coherence and similarity were computed using the algorithms described in Schvaneveldt (1990). Coherence is an index of transitivity among concepts and indicates consistency in knowledge and ratings. Similarity is an index of correspondence of ratings provided by different raters. If different team members have similar knowledge structures regarding key elements of the task, then the similarity between ratings of key task concepts should be high. The average similarity of

dyadic pairs of ratings in a team was used to assess sharedness of knowledge structures in a team.

Training performance and performance adaptability. Performance was assessed via several measures provided by TAS, including score, number of contacts processed, percentage accuracy in decisions, and penalty intrusions. See Appendix G for a summary of all the performance measures available for TAS. All of the outcome measures of task performance were highly correlated. For example, the correlations between score and number of contacts processed ranged from 0.76 to 0.94, and the correlations between penalty intrusions and percentage accuracy in decisions ranged from -0.31 to -0.41. Thus, performance was exemplified by a constellation of effective behaviors. Individuals and teams who could process more contacts also did them more accurately, had fewer penalty intrusions, and scored more points.

Both individual and team level outcome variables were obtained in the study. The number of contacts engaged and penalty intrusions were team level variables, as was the team score. These were team variables because the same values would be assigned to all members of a given team for these particular variables. Individual level outcomes also existed. The performance of individual members was determined by the accuracy and number of decisions of a given team member performing in his or her role. Thus, one team member could perform quite well as compared to another team member in the same team. However, team performance was highly interdependent, so the total team performance was constrained by the performances of all three members. Because of the high levels of interdependence, the multiple correlation between individual and team performance would be expected to be high. The R^2 values for predicting team score using individual scores of

the three team members for each of the six trials were .95, .96, .89, .89, .82, .94, respectively. These values suggest that although individual scores could vary within a team, they were important individual level outcomes of training in a team environment. They also suggest that the data from the individual trials for each position could be modeled as indicators of team performance. The individual and team scoring methods are presented in Table 3. The scoring methods were consistent with previous studies involving the use of TANDEMS software (Baker, 1991; Dwyer et al., 1992; Ford et al., 1995; Kozlowski et al., 1995).

The final set of outcome performance variables analyzed for the current study included team score, individual score, and penalty circle intrusions. Score was a useful amalgamation of the outcomes of interest because all of the outcome variables regarding decisions were highly intercorrelated. Penalty circle intrusions were analyzed separately because they were less strongly correlated with the other outcome variables. The linear dependency of score with penalty circles was eliminated by recomputing individual and team scores as described in Table 3, but without consideration of the number of penalty circle intrusions. The final set of performance outcome measures from TAS analyzed in this study included one individual level variable (individual score for role performance) and two team level variables (team score, penalty circle intrusions). These variables were used to assess skill level during training and performance adaptability on the final task.

Affect/Attitudes. Several affective and attitudinal variables regarding individual and team-oriented perceptions were measured at the end of day one and day two, prior to the adaptability task. Items for these scales were all written in five point Likert scale format. Affective and attitudinal variables included individual and team-oriented

satisfaction as well as social and task cohesion. See Appendix D for a description of these scales and the actual items employed in the study.

Satisfaction was measured using items adapted from Carsten (1987) for both individual and team oriented satisfaction. Individual satisfaction included items like “I am generally satisfied while performing this task.” Team oriented satisfaction included items reworded to describe the team as a unit: “The team is generally satisfied while performing this task.” See Appendix D for measures of individual and team satisfaction. A common factors analysis with an oblique oblimin rotation yielded a one factor solution for both day one and day two measures, suggesting that there was a general satisfaction measure underlying responses to the questions. All items were retained but combined to yield a single satisfaction measure. The final coefficient alpha reliability estimates for the satisfaction measures were .84 and .88 for days one and two, respectively. Results were similar when analyzed at the team level and by position.

Cohesion was measured using items adapted from Widmeyer, Brawley, and Carron (1985). There were two different types of cohesion measured, task and social. Measures of task cohesion referred to cohesive goals and a shared orientation toward task performance. They included items like “our team is united in trying to reach its goals for performance.” Measures of social cohesion referred to a shared orientation toward social issues. They included items like “our team would like to spend time together socially.” A common factors analysis with an oblique oblimin rotation on the satisfaction and cohesion items together yielded a three factor structure corresponding to satisfaction, task cohesion, and social cohesion. An common factors analysis with an oblique oblimin rotation on only the cohesion items yielded a two factor structure consisting of task and

social cohesion. The loadings were all above .55 for each of the items on the constructs of interest for factor analytic results on both days. These results suggest satisfaction is a construct that is distinct from cohesion, and two types of cohesion were measured, task and social. The reliability estimates for social cohesion on days one and two were .65 and .71, respectively. The reliability estimates for task cohesion on days one and two were .56 and .65, respectively. Task and social cohesion were correlated .36 and .41 on days one and two. Results were similar at the team level and when analyzed by position. However, at the team level, the factor structure of cohesion was slightly less clear on day one, and the reliabilities were noticeably higher. The reliabilities for task cohesion at the team level were .67 and .77 on days one and two, respectively. The reliabilities for social cohesion at the team level were .75 and .80 on days one and two, respectively. The correlations between social and task cohesion on days one and two were .56 and .49. Overall, the analyses provided substantial support for a two factor structure of cohesion and the measures demonstrated acceptable reliabilities.

Summary

Participants performed six trials of a complex decision making task in three-person highly interdependent teams. Variables of interest in the current study included manipulated feedback variables and a number of indicators of regulatory processes and learning outcomes. Procedures were standardized and learning opportunities were equated across conditions. Thus, any impact of feedback could occur only through its impact on self-regulatory and motivational processes. The measures included in the study demonstrated consistent factor structures and moderate to high levels of reliability.

The analytical techniques employed are complex due to the multiple levels of analysis for the constructs and measures included in the study. Failure to consider the multiple levels involved can lead to inappropriate conclusions and generalizations (Klein et al., 1994; Rousseau, 1985). In order to address the multiple levels of analysis, various techniques were employed. The analytical approaches employed to test the hypotheses of interest included repeated measures regression (Cohen & Cohen, 1983; Hollenbeck, Ilgen, & Sego, 1994; Gully, 1994; Pedhazur, 1982), hierarchical linear modeling (Bryk & Raudenbush, 1992), multivariate multiple regression (Stevens, 1992), and doubly multivariate repeated measures MANOVA (SPSS, 1988). Each of these techniques have particular strengths and weaknesses.

In the results section a brief description of each analytical technique will be provided, followed by specific tests of hypotheses. The results of each test will be briefly described with an indication of full, partial, limited, or no support for the particular hypotheses being tested.

RESULTS

Descriptive Statistics

The final set of measures, means, standard deviations, and correlations at the individual and team levels are presented in Table 5. The correlations below the diagonal correspond to individual level correlations computed on the entire sample. The correlations above the diagonal in italics correspond to team level correlations computed using mean scores within teams. The diagonal contains the reliability estimates using the individual level measures. The team level measures tended to have higher reliability estimates, so the individual level reliabilities are generally a conservative estimate. In the case of true team variables (e.g., feedback, penalty circle intrusions), the same value was assigned to all members of a given team. It should be noted that team scores were measured differently from individual scores and are not simply averages of the individual scores. Team scores were comprised of the performances of the teams as units whereas individual scores were comprised of the role performances of members in a given position.

The correlations presented have to be interpreted cautiously because each set ignores the alternative level of analysis. For example, with the exception of the feedback manipulations, team scores, and penalty circle intrusions, team level variables were computed by averaging the individual responses of the team members. This process can potentially lead to aggregation bias if agreement or homogeneity in individual responses

Table 5.

Means, Standard Deviations, and Intercorrelations Among Variables

Variable Name	Mean	Team Std Deviation	Individual Std Deviation	Team N	Individual N
1. Individual Feedback (INDFB)*	0.49	0.50	0.50	89	267
2. Team Feedback (TMFB)*	0.49	0.50	0.50	89	267
3. Cognitive Ability (COGABIL)	24.43	3.49	5.81	88	267
4. Self-Efficacy End of Trial 1 (SEFFT1)	3.70	0.45	0.72	88	264
5. Self-Efficacy End of Trial 2 (SEFFT2)	3.85	0.38	0.65	88	264
6. Self-Efficacy End of Trial 3 (SEFFT3)	4.03	0.32	0.54	81	243
7. Self-Efficacy End of Trial 4 (SEFFT4)	4.08	0.37	0.60	81	243
8. Personal Team-Efficacy End of Trial 1 (PTEFFT1)	3.71	0.40	0.56	88	264
9. Personal Team-Efficacy End of Trial 2 (PTEFFT2)	3.73	0.46	0.67	88	264
10. Personal Team-Efficacy End of Trial 3 (PTEFFT3)	3.96	0.37	0.58	81	243
11. Personal Team-Efficacy End of Trial 4 (PTEFFT4)	4.00	0.45	0.64	81	243
12. Individual Goal Prior to Trial 2 (IGOAL1)	0.03	1.48	2.24	88	261
13. Individual Goal Prior to Trial 3 (IGOAL2)	-0.02	1.43	2.27	88	259
14. Individual Goal Prior to Trial 4 (IGOAL3)	-0.07	1.35	2.23	81	236
15. Individual Goal Prior to Trial 5 (IGOAL4)	-0.09	1.41	2.26	81	238
16. Team Goal Prior to Trial 2 (TGOAL1)	-0.00	1.38	2.12	87	258
17. Team Goal Prior to Trial 3 (TGOAL2)	-0.07	1.33	1.98	88	262
18. Team Goal Prior to Trial 4 (TGOAL3)	-0.04	1.41	2.26	81	237
19. Team Goal Prior to Trial 5 (TGOAL4)	-0.09	1.49	2.22	81	238
20. Individual Goal Commitment for IGOAL1 (IGC1)	3.73	0.37	0.69	88	264
21. Individual Goal Commitment for IGOAL2 (IGC2)	3.80	0.36	0.68	88	264
22. Individual Goal Commitment for IGOAL3 (IGC3)	3.88	0.42	0.72	81	243
23. Individual Goal Commitment for IGOAL4 (IGC4)	3.94	0.46	0.78	81	242
24. Individual Goal Commitment for Do Your Best on Final	3.95	0.42	0.73	81	243

Table 5 (Cont'd).

Variable Name	Mean	Team Std Deviation	Individual Std Deviation	Team N	Individual N
25. Team Goal Commitment for TGOAL1 (TGC1)	3.81	0.36	0.66	88	264
26. Team Goal Commitment for TGOAL2 (TGC2)	3.86	0.38	0.69	88	264
27. Team Goal Commitment for TGOAL3 (TGC3)	3.99	0.40	0.67	81	243
28. Team Goal Commitment for TGOAL4 (TGC4)	4.03	0.44	0.72	81	243
29. Team Goal Commitment for Do Your Best on Final	4.05	0.42	0.69	81	243
30. Self-Efficacy at End of Day 1 (SEFFD1)	4.02	0.37	0.58	86	258
31. Personal Team-Efficacy at End of Day 1 (PTEFFD1)	3.92	0.46	0.65	86	258
32. Role Clarity at End of Day 1 (RLCLD1)	4.33	0.40	0.58	86	258
33. Interpositional Certainty at End of Day 1 (IPCD1)	3.99	0.38	0.65	86	258
34. Satisfaction at End of Day 1 (SATISD1)	3.79	0.39	0.56	86	258
35. Individual Frustration at End of Day 1 (IFRUSD1)	2.76	0.54	0.85	86	258
36. Team-Oriented Frustration at End of Day 1 (TFRUSD1)	2.67	0.54	0.74	86	258
37. Social Cohesion at End of Day 1 (SOCCOHD1)	3.11	0.43	0.61	86	258
38. Task Cohesion at End of Day 1 (TSKCOHD1)	3.81	0.34	0.51	86	258
39. Self-Efficacy at End of Day 2 (SEFFD2)	4.15	0.34	0.57	81	243
40. Personal Team-Efficacy at End of Day 2 (PTEFFD2)	4.12	0.38	0.58	81	243
41. Role Clarity at End of Day 2 (RLCLD2)	4.53	0.36	0.50	81	243
42. Interpositional Certainty at End of Day 2 (IPCD2)	4.24	0.45	0.63	81	243
43. Satisfaction at End of Day 2 (SATISD2)	3.91	0.41	0.60	81	243
44. Individual Frustration at End of Day 2 (IFRUSD2)	2.55	0.56	0.83	81	243
45. Team-Oriented Frustration at End of Day 2 (TFRUSD2)	2.52	0.49	0.72	81	243
46. Social Cohesion at End of Day 2 (SOCCOHD2)	3.08	0.49	0.68	81	242
47. Task Cohesion at End of Day 2 (TSKCOHD2)	3.97	0.41	0.57	81	242
48. Individual Declarative Knowledge (IDECKD2)	0.77	0.13	0.20	81	243
49. Team-Oriented Declarative Knowledge (TDECKD2)	0.81	0.09	0.14	81	243

Table 5 (Cont'd).

Variable Name	Team		Individual		Team		Individual		Team		Individual	
	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation	Mean	Std Deviation
50. Coherence of Knowledge Structure (COHERD2)	0.26	0.10	0.17		79		79		237		237	
51. Similarity of Knowledge Structure (SIMD2)	0.20	0.07	0.06		79		79		237		237	
52. Score on Training Trial 1 (SCORE1) ^b	252.13	(137.64)	169.93		89		89		267		267	
53. Score on Training Trial 2 (SCORE2) ^b	782.05	(432.95)	510.90		88		88		264		264	
54. Score on Training Trial 3 (SCORE3) ^b	1512.95	(832.01)	771.95		88		88		264		264	
55. Score on Training Trial 4 (SCORE4) ^b	1841.48	(1022.43)	766.23		81		81		243		243	
56. Score on Training Trial 5 (SCORE5) ^b	2474.07	(1362.55)	876.69		81		81		243		243	
57. Score on Performance Adaptability Task (SCORE6) ^b	3267.78	(1801.65)	1701.50		81		81		243		243	
58. Penalty Intrusions on Training Trial 1 (PENINT1) ^a	3.24	1.71	1.70		89		89		267		267	
59. Penalty Intrusions on Training Trial 2 (PENINT2) ^a	7.97	1.38	1.37		88		88		264		264	
60. Penalty Intrusions on Training Trial 3 (PENINT3) ^a	5.64	2.44	2.43		88		88		264		264	
61. Penalty Intrusions on Training Trial 4 (PENINT4) ^a	3.74	2.38	2.37		81		81		243		243	
62. Penalty Intrusions on Training Trial 5 (PENINT5) ^a	2.28	2.25	2.24		81		81		243		243	
63. Penalty Intrusions on Perf Adaptability Task (PENINT6) ^a	10.16	3.80	3.78		81		81		243		243	
64. Retrospective Individual Motivation (IMOT)	4.43	0.42	0.61		81		81		243		243	
65. Retrospective Team Motivation (TMOT)	4.41	0.51	0.67		81		81		243		243	
66. Task Withdrawal (WITHDRW)	2.22	0.47	0.66		81		81		243		243	

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. INDFB ^a	(1.00)	0.06	-0.18	0.05	-0.11	0.05	-0.01	0.14	0.06	0.04	0.01	0.09	-0.15	-0.06	-0.14
2. TMFB ^a	0.06	(1.00)	0.11	-0.02	0.12	0.15	0.11	0.07	0.21*	0.14	0.11	0.14	0.09	0.23*	0.07
3. COGABIL	-0.11	0.06	(0.88)	0.21*	0.10	0.07	0.09	0.20	0.10	0.10	0.12	0.09	0.12	-0.04	-0.00
4. SEFFT1	0.03	-0.01	0.22*	(0.92)	0.57*	0.48*	0.30*	0.67*	0.47*	0.43*	0.32*	0.55*	0.47*	0.32*	0.33*
5. SEFFT2	-0.06	0.07	0.16*	0.59*	(0.93)	0.61*	0.41*	0.47*	0.77*	0.46*	0.33*	0.45*	0.61*	0.36*	0.26*
6. SEFFT3	0.03	0.09	0.05	0.46*	0.56*	(0.92)	0.77*	0.33*	0.46*	0.78*	0.63*	0.31*	0.33*	0.35*	0.29*
7. SEFFT4	-0.01	0.07	-0.00	0.36*	0.43*	0.76*	(0.94)	0.25*	0.36*	0.69*	0.85*	0.23*	0.27*	0.27*	0.39*
8. PTEFFT1	0.09	0.05	0.03	0.57*	0.46*	0.34*	0.27*	(0.92)	0.68*	0.48*	0.45*	0.45*	0.42*	0.20	0.19

Table 5 (Cont'd).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
9. PTEFFT2	0.04	0.14*	-0.03	0.33*	0.65*	0.44*	0.35*	0.65*	(0.94)	0.52*	0.42*	0.39*	0.51*	0.31*	0.19
10. PTEFFT3	0.03	0.09	-0.05	0.30*	0.40*	0.73*	0.65*	0.47*	0.58*	(0.92)	0.81*	0.23*	0.26*	0.29*	0.24*
11. PTEFFT4	0.01	0.08	-0.06	0.20*	0.29*	0.60*	0.75*	0.43*	0.47*	0.80*	(0.94)	0.24*	0.26*	0.24*	0.34*
12. IGOAL1	0.05	0.10	0.11	0.51*	0.41*	0.30*	0.26*	0.33*	0.28*	0.20*	0.21*	(0.63)	0.76*	0.61*	0.54*
13. IGOAL2	-0.09	0.07	0.09	0.40*	0.55*	0.30*	0.25*	0.32*	0.40*	0.21*	0.18*	0.71*	(0.66)	0.75*	0.69*
14. IGOAL3	-0.02	0.16*	-0.01	0.27*	0.39*	0.41*	0.34*	0.19*	0.35*	0.33*	0.29*	0.58*	0.70*	(0.68)	0.80*
15. IGOAL4	-0.09	0.04	-0.07	0.25*	0.31*	0.39*	0.43*	0.19*	0.29*	0.32*	0.35*	0.47*	0.65*	0.80*	(0.65)
16. TGOAL1	0.10	0.07	-0.02	0.42*	0.32*	0.23*	0.21*	0.41*	0.33*	0.24*	0.23*	0.71*	0.54*	0.44*	0.38*
17. TGOAL2	0.00	0.11	-0.03	0.30*	0.41*	0.20*	0.18	0.42*	0.49*	0.25*	0.25*	0.54*	0.72*	0.52*	0.43*
18. TGOAL3	0.02	0.12	-0.04	0.27*	0.36*	0.38*	0.37*	0.32*	0.44*	0.39*	0.39*	0.47*	0.58*	0.71*	0.59*
19. TGOAL4	0.01	0.07	0.03	0.27*	0.32*	0.33*	0.41*	0.31*	0.38*	0.35*	0.46*	0.46*	0.56*	0.61*	0.69*
20. IGC1	-0.12*	0.01	0.17*	0.28*	0.18*	0.12	0.12	0.17*	0.01	0.05	0.07	0.32*	0.24*	0.18*	0.18*
21. IGC2	-0.10	0.00	0.16*	0.28*	0.33*	0.27*	0.23*	0.23*	0.19*	0.22*	0.19*	0.32*	0.38*	0.33*	0.28*
22. IGC3	-0.00	0.09	-0.05	0.20*	0.22*	0.30*	0.27*	0.20*	0.18*	0.29*	0.26*	0.34*	0.25*	0.33*	0.30*
23. IGC4	-0.00	0.13*	-0.02	0.16*	0.17*	0.31*	0.37*	0.19*	0.19*	0.33*	0.37*	0.30*	0.20*	0.30*	0.32*
24. IGC FN	-0.00	0.11	0.00	0.12	0.20*	0.30*	0.29*	0.16*	0.18*	0.28*	0.29*	0.32*	0.24*	0.28*	0.26*
25. TGC1	-0.02	0.06	0.15*	0.33*	0.26*	0.15*	0.19*	0.33*	0.15*	0.12	0.23*	0.32*	0.30*	0.21*	0.22*
26. TGC2	-0.05	0.05	0.08	0.25*	0.28*	0.26*	0.26*	0.28*	0.26*	0.26*	0.28*	0.30*	0.31*	0.31*	0.28*
27. TGC3	0.01	0.09	0.01	0.25*	0.21*	0.35*	0.36*	0.25*	0.25*	0.40*	0.40*	0.34*	0.22*	0.30*	0.28*
28. TGC4	-0.00	0.11	0.06	0.23*	0.19*	0.33*	0.40*	0.26*	0.27*	0.38*	0.44*	0.36*	0.23*	0.30*	0.32*
29. TGC FN	0.03	0.10	0.08	0.21*	0.21*	0.31*	0.35*	0.20*	0.21*	0.34*	0.37*	0.38*	0.23*	0.26*	0.24*
30. SEFFD1	0.09	0.11	0.04	0.53*	0.68*	0.62*	0.46*	0.40*	0.50*	0.50*	0.35*	0.34*	0.37*	0.33*	0.25*
31. PTEFFD1	0.11	0.15*	-0.08	0.27*	0.41*	0.41*	0.33*	0.55*	0.66*	0.59*	0.50*	0.22*	0.25*	0.29*	0.22*
32. RLCLD1	0.03	0.09	0.18*	0.37*	0.44*	0.38*	0.30*	0.20*	0.28*	0.24*	0.20*	0.32*	0.31*	0.27*	0.20*
33. IPCD1	-0.01	0.13*	0.11	0.37*	0.40*	0.30*	0.24*	0.22*	0.27*	0.21*	0.17*	0.25*	0.33*	0.29*	0.30*
34. SATISD1	-0.02	0.16*	0.14*	0.27*	0.27*	0.18*	0.12*	0.28*	0.33*	0.29*	0.25*	0.24*	0.22*	0.23*	0.18*

Table 5 (Cont'd).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
35. IFRUSD1	-0.08	-0.10	-0.16*	-0.32*	-0.31*	-0.22*	-0.10	-0.30*	-0.31*	-0.29*	-0.14*	-0.11	-0.09	-0.02	0.03
36. TFRUSD1	-0.07	-0.05	-0.04	-0.19*	-0.23*	-0.26*	-0.18*	-0.37*	-0.39*	-0.39*	-0.29*	-0.09	-0.06	-0.05	-0.02
37. SOCCOHD1	0.03	0.05	0.03	0.14*	0.07	0.13*	0.14*	0.19*	0.19*	0.20*	0.22*	0.09	0.12*	0.08	0.11
38. TSKCOHD1	-0.01	0.03	0.10	0.19*	0.16*	0.16*	0.19*	0.34*	0.40*	0.29*	0.26*	0.23*	0.20*	0.13*	0.18*
39. SEFFD2	-0.06	0.01	0.06	0.35*	0.46*	0.75*	0.83*	0.26*	0.33*	0.63*	0.64*	0.24*	0.21*	0.29*	0.35*
40. PTEFFD2	-0.01	0.07	0.03	0.22*	0.31*	0.66*	0.76*	0.32*	0.36*	0.71*	0.78*	0.19*	0.16*	0.25*	0.29*
41. RLCLD2	-0.03	0.08	0.06	0.29*	0.28*	0.41*	0.46*	0.15*	0.18*	0.34*	0.37*	0.27*	0.20*	0.21*	0.27*
42. IPCD2	-0.02	0.06	0.09	0.25*	0.28*	0.34*	0.37*	0.15*	0.15*	0.28*	0.27*	0.12	0.11	0.10	0.18*
43. SATISD2	-0.00	0.15*	0.02	0.08	0.06	0.15*	0.18*	0.15*	0.14*	0.24*	0.29*	0.16*	0.06	0.12	0.14*
44. IFRUSD2	0.05	-0.02	-0.16*	-0.20*	-0.24*	-0.34*	-0.31*	-0.25*	-0.23*	-0.33*	-0.26*	-0.03	-0.06	-0.06	-0.10
45. TFRUSD2	0.00	-0.11	-0.08	-0.18*	-0.20*	-0.31*	-0.27*	-0.26*	-0.24*	-0.38*	-0.30*	-0.09	-0.10	-0.10	-0.09
46. SOCCOHD2	0.00	-0.02	-0.08	0.13*	-0.04	0.06	0.11	0.10	0.00	0.13*	0.17*	0.13*	0.05	-0.04	0.01
47. TSKCOHD2	-0.05	0.05	0.08	0.07	0.08	0.17*	0.20*	0.17*	0.22*	0.27*	0.28*	0.23*	0.14*	0.14*	0.14*
48. IDECKD2	-0.08	-0.00	0.32*	0.11	0.09	0.12*	0.12	0.06	-0.06	0.00	0.07	0.12	0.07	0.02	0.08
49. TDECKD2	-0.11	0.04	0.33*	0.12	0.08	0.05	0.06	-0.01	-0.14*	-0.06	0.02	0.13*	0.10	0.08	0.14*
50. COHERD2	-0.04	0.06	0.16*	-0.00	-0.04	0.04	0.04	-0.00	-0.07	0.02	0.09	-0.09	-0.11	-0.06	-0.09
51. SIMD2	-0.08	0.09	0.21*	0.14*	0.10	0.10	0.07	0.15*	0.08	0.09	0.06	0.24*	0.16*	0.05	0.14*
52. SCORE1 ^b	-0.03	0.13*	0.28*	0.20*	0.08	0.11	0.11	0.09	0.03	0.08	0.15*	0.15*	0.13*	0.08	0.09
53. SCORE2 ^b	-0.04	0.04	0.30*	0.16*	0.22*	0.21*	0.21*	0.12	0.24*	0.19*	0.22*	0.07	0.13*	0.16*	0.18*
54. SCORE3 ^b	0.04	0.17*	0.24*	0.23*	0.24*	0.17*	0.16*	0.12*	0.22*	0.21*	0.19*	0.20*	0.19*	0.28*	0.22*
55. SCORE4 ^b	0.06	0.19*	0.21*	0.15*	0.20*	0.17*	0.23*	0.06	0.17*	0.16*	0.24*	0.12	0.11	0.23*	0.26*
56. SCORE5 ^b	-0.02	0.15*	0.25*	0.10	0.14*	0.16*	0.20*	-0.03	0.06	0.12	0.16*	0.10	0.07	0.17*	0.17*
57. SCORE6 ^b	-0.02	0.17*	0.23*	0.09	0.12	0.15*	0.17*	0.04	0.13*	0.15*	0.18*	0.15*	0.11	0.18*	0.18*
58. PENINT1*	-0.06	0.06	-0.03	0.07	0.08	0.04	0.02	0.08	0.11	0.03	0.02	0.01	0.03	0.12	0.04
59. PENINT2*	0.09	-0.02	-0.17*	-0.09	-0.10	-0.05	-0.11	-0.14*	-0.14*	-0.08	-0.14*	0.00	-0.03	0.01	-0.03
60. PENINT3*	-0.08	-0.08	-0.26*	-0.25*	-0.18*	-0.10	-0.13*	-0.27*	-0.25*	-0.15*	-0.19*	-0.09	-0.13*	-0.09	-0.06

Table 5 (Cont'd).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
61. PENINT4 ^a	-0.07	-0.14*	-0.27*	-0.14*	-0.13*	-0.12	-0.12	-0.16*	-0.19*	-0.16*	-0.15*	-0.04	-0.10	-0.08	-0.11
62. PENINT5 ^a	-0.06	-0.20*	-0.27	-0.16*	-0.15*	-0.13*	-0.13*	-0.16*	-0.18*	-0.17*	-0.14*	-0.12	-0.13*	-0.10	-0.15*
63. PENINT6 ^a	0.00	-0.17*	-0.24*	-0.21*	-0.16*	-0.11	-0.12	-0.23*	-0.24*	-0.24*	-0.21*	-0.15*	-0.13*	-0.09	-0.11
64. IMOT	-0.05	0.15*	0.01	0.15*	0.23*	0.19*	0.27*	0.20*	0.22*	0.20*	0.28*	0.19*	0.18*	0.13*	0.20*
65. TMOT	0.07	0.15*	-0.00	0.05	0.07	0.14*	0.22*	0.28*	0.25*	0.25*	0.32*	0.13*	0.09	0.11	0.15*
66. WITHDRW	-0.03	-0.13*	-0.13*	-0.21*	-0.10	-0.16*	-0.18*	-0.22*	-0.08	-0.22*	-0.25*	0.15*	-0.06	-0.08	-0.12
Variable	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1. INDFB ^a	0.16	-0.00	0.02	0.00	-0.24*	-0.18	0.00	-0.01	-0.01	-0.04	-0.10	0.02	-0.01	0.05	0.15
2. TMFB ^a	0.08	0.15	0.19	0.09	0.01	0.00	0.15	0.22*	0.19	0.11	0.10	0.15	0.18	0.16	0.17
3. COGABIL	0.03	0.12	0.09	0.22*	0.11	0.13	-0.19	-0.14	0.02	0.19	0.08	-0.06	0.01	0.12	-0.02
4. SEFFT1	0.51*	0.39*	0.33*	0.36*	0.23*	0.24*	0.26*	0.22*	0.20	0.31*	0.23*	0.30*	0.27*	0.23*	0.49*
5. SEFFT2	0.35*	0.50*	0.37*	0.36*	0.15	0.35*	0.26*	0.23*	0.33*	0.21*	0.29*	0.24*	0.21	0.28*	0.64*
6. SEFFT3	0.24*	0.25*	0.36*	0.33*	0.07	0.32*	0.33*	0.41*	0.42*	0.15	0.26*	0.37*	0.38*	0.36*	0.66*
7. SEFFT4	0.18	0.24*	0.34*	0.48*	0.05	0.29*	0.23*	0.42*	0.41*	0.19	0.33*	0.39*	0.49*	0.43*	0.41*
8. PTEFFT1	0.54*	0.50*	0.34*	0.40*	0.24*	0.31*	0.27*	0.25*	0.26*	0.50*	0.43*	0.33*	0.32*	0.26*	0.40*
9. PTEFFT2	0.42*	0.60*	0.44*	0.42*	0.15	0.38*	0.30*	0.29*	0.29*	0.33*	0.47*	0.38*	0.37*	0.34*	0.54*
10. PTEFFT3	0.24*	0.26*	0.40*	0.40*	0.16	0.39*	0.44*	0.49*	0.44*	0.35*	0.44*	0.57*	0.54*	0.52*	0.52*
11. PTEFFT4	0.22*	0.26*	0.39*	0.54*	0.16	0.40*	0.34*	0.54*	0.47*	0.34*	0.47*	0.54*	0.60*	0.55*	0.34*
12. IGOAL1	0.74*	0.63*	0.52*	0.50*	0.48*	0.43*	0.41*	0.39*	0.45*	0.49*	0.38*	0.36*	0.40*	0.41*	0.41*
13. IGOAL2	0.60*	0.81*	0.60*	0.59*	0.33*	0.45*	0.35*	0.35*	0.42*	0.32*	0.40*	0.29*	0.33*	0.31*	0.44*
14. IGOAL3	0.39*	0.58*	0.70*	0.56*	0.30*	0.42*	0.46*	0.43*	0.42*	0.25*	0.42*	0.33*	0.38*	0.33*	0.37*
15. IGOAL4	0.39*	0.47*	0.59*	0.71*	0.30*	0.35*	0.36*	0.44*	0.37*	0.24*	0.37*	0.31*	0.42*	0.30*	0.28*
16. TGOAL1	(0.55)	0.69*	0.51*	0.49*	0.38*	0.32*	0.38*	0.37*	0.36*	0.58*	0.45*	0.41*	0.42*	0.36*	0.38*
17. TGOAL2	0.65*	(0.51)	0.65*	0.58*	0.25*	0.40*	0.29*	0.27*	0.34*	0.42*	0.50*	0.34*	0.33*	0.32*	0.37*
18. TGOAL3	0.50*	0.66*	(0.63)	0.79*	0.33*	0.42*	0.43*	0.39*	0.43*	0.39*	0.54*	0.50*	0.47*	0.45*	0.38*
19. TGOAL4	0.50*	0.58*	0.80*	(0.61)	0.30*	0.40*	0.26*	0.38*	0.37*	0.38*	0.49*	0.41*	0.48*	0.43*	0.36*

Table 5 (Cont'd).

Variable	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
20. IGC1	0.22*	0.12	0.15*	0.08	(0.74)	0.58*	0.44*	0.37*	0.32*	0.70*	0.54*	0.44*	0.46*	0.44*	0.07
21. IGC2	0.23*	0.25*	0.28*	0.22*	0.69*	(0.82)	0.64*	0.65*	0.60*	0.55*	0.80*	0.59*	0.62*	0.57*	0.36*
22. IGC3	0.27*	0.19*	0.29*	0.17*	0.57*	0.71*	(0.85)	0.85*	0.79*	0.51*	0.62*	0.82*	0.74*	0.72*	0.37*
23. IGC4	0.25*	0.15*	0.26*	0.25*	0.50*	0.67*	0.87*	(0.87)	0.82*	0.46*	0.65*	0.80*	0.85*	0.77*	0.32*
24. IGC FN	0.23*	0.13*	0.21*	0.16*	0.50*	0.64*	0.81*	0.82*	(0.86)	0.39*	0.59*	0.72*	0.73*	0.83*	0.41*
25. TGC1	0.39*	0.27*	0.25*	0.16*	0.76*	0.63*	0.52*	0.44*	0.43*	(0.78)	0.62*	0.59*	0.61*	0.56*	0.14
26. TGC2	0.30*	0.32*	0.36*	0.27*	0.62*	0.82*	0.67*	0.62*	0.63*	0.66*	(0.87)	0.73*	0.75*	0.67*	0.27*
27. TGC3	0.30*	0.21*	0.38*	0.27*	0.52*	0.63*	0.82*	0.77*	0.72*	0.52*	0.73*	(0.88)	0.89*	0.81*	0.27*
28. TGC4	0.32*	0.22*	0.35*	0.30*	0.53*	0.62*	0.78*	0.84*	0.74*	0.54*	0.71*	0.89*	(0.88)	0.84*	0.20
29. TGC FN	0.28*	0.19*	0.30*	0.22*	0.54*	0.62*	0.72*	0.72*	0.82*	0.55*	0.70*	0.80*	0.82*	(0.87)	0.27*
30. SEFFD1	0.33*	0.33*	0.35*	0.28*	0.13*	0.26*	0.26*	0.21*	0.23*	0.17*	0.25*	0.28*	0.20*	0.20*	(0.92)
31. PTEFFD1	0.30*	0.37*	0.36*	0.32*	0.06	0.22*	0.29*	0.27*	0.29*	0.13*	0.28*	0.35*	0.31*	0.27*	0.67*
32. RLCLD1	0.15*	0.25*	0.22*	0.24*	0.19*	0.29*	0.20*	0.14*	0.22*	0.14*	0.21*	0.18*	0.20*	0.21*	0.48*
33. IPCD1	0.19*	0.25*	0.22*	0.25*	0.24*	0.29*	0.15*	0.13*	0.15*	0.28*	0.25*	0.14*	0.16*	0.20*	0.36*
34. SATISD1	0.18*	0.22*	0.24*	0.17*	0.32*	0.43*	0.43*	0.40*	0.37*	0.31*	0.43*	0.46*	0.44*	0.44*	0.32*
35. IFRUSD1	-0.02	-0.05	-0.00	0.10	-0.03	-0.06	-0.09	-0.02	-0.06	-0.03	-0.05	-0.05	0.01	-0.05	-0.33*
36. TFRUSD1	-0.09	-0.19*	-0.14*	-0.09	-0.03	-0.10	-0.13*	-0.10	-0.16*	-0.08	-0.10	-0.14*	-0.10	-0.15*	-0.26*
37. SOCCOHD1	0.15*	0.16*	0.14*	0.19*	0.16*	0.20*	0.17*	0.21*	0.21*	0.23*	0.30*	0.25*	0.34*	0.31*	0.04
38. TSKCOHD1	0.18*	0.24*	0.24*	0.21*	0.27*	0.35*	0.33*	0.34*	0.31*	0.33*	0.42*	0.42*	0.45*	0.41*	0.15*
39. SEFFD2	0.19*	0.15*	0.30*	0.34*	0.15*	0.23*	0.25*	0.33*	0.32*	0.17*	0.24*	0.34*	0.38*	0.35*	0.52*
40. PTEFFD2	0.19*	0.17*	0.31*	0.38*	0.10	0.19*	0.22*	0.30*	0.32*	0.15*	0.23*	0.34*	0.39*	0.36*	0.40*
41. RLCLD2	0.15*	0.13*	0.21*	0.29*	0.20*	0.29*	0.26*	0.33*	0.31*	0.21*	0.24*	0.30*	0.37*	0.37*	0.36*
42. IPCD2	0.05	0.03	0.09	0.20*	0.11	0.16*	0.12*	0.17*	0.19*	0.16*	0.11	0.16*	0.17*	0.23*	0.26*
43. SATISD2	0.12	0.08	0.10	0.12	0.25*	0.34*	0.44*	0.51*	0.49*	0.25*	0.37*	0.50*	0.54*	0.54*	0.14*
44. IFRUSD2	0.07	-0.08	-0.05	-0.06	-0.04	-0.19*	-0.09	-0.18*	-0.15*	-0.11	-0.15*	-0.15*	-0.17*	-0.20*	-0.29*
45. TFRUSD2	-0.02	-0.08	-0.09	-0.12	-0.00	-0.09	-0.06	-0.08	-0.11	-0.07	-0.05	-0.09	-0.10	-0.11	-0.22*

Table 5 (Cont'd).

Variable	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
46. SOCCOHD2	0.19*	0.10	0.05	0.08	0.23*	0.23*	0.16*	0.21*	0.20*	0.28*	0.25*	0.29*	0.34*	0.34*	-0.03
47. TSKCOHD2	0.19*	0.15*	0.14*	0.18*	0.32*	0.38*	0.35*	0.42*	0.39*	0.29*	0.35*	0.42*	0.48*	0.49*	0.06
48. IDECKD2	0.06	-0.02	-0.02	0.01	0.22*	0.13*	0.14*	0.16*	0.19*	0.15*	0.14*	0.18*	0.22*	0.25*	0.14*
49. TDECKD2	0.08	0.02	-0.02	0.07	0.18*	0.09	0.02	0.07	0.10	0.15*	0.04	0.05	0.10	0.18*	-0.01
50. COHERD2	-0.09	-0.07	-0.07	-0.04	0.10	0.04	0.04	0.06	0.06	0.10	0.10	0.09	0.09	0.13*	-0.05
51. SIMD2	0.13*	0.14*	0.11	0.18*	0.16*	0.11	0.09	0.06	0.14*	0.17*	0.05	0.08	0.09	0.17*	0.13*
52. SCORE1 ^b	0.10	0.14*	0.18*	0.24*	0.05	0.06	0.03	0.03	0.07	0.07	0.08	0.11	0.10	0.12	0.11
53. SCORE2 ^b	0.00	0.13*	0.20*	0.25*	0.10	0.11	0.01	0.03	0.12	0.06	0.15*	0.09	0.14*	0.17*	0.17*
54. SCORE3 ^b	0.10	0.11	0.23*	0.28*	0.16*	0.13*	0.10	0.09	0.14*	0.13*	0.12*	0.13*	0.11	0.14*	0.25*
55. SCORE4 ^b	0.09	0.05	0.17*	0.27*	0.14*	0.11	0.08	0.13*	0.16*	0.12	0.14*	0.11	0.13*	0.15*	0.22*
56. SCORE5 ^b	0.07	0.01	0.09	0.20*	0.18*	0.12	0.04	0.08	0.12	0.12	0.11	0.05	0.08	0.08	0.18*
57. SCORE6 ^b	0.12	0.11	0.09	0.19*	0.23*	0.18*	0.15*	0.17*	0.21*	0.19*	0.19*	0.15*	0.19*	0.18*	0.18*
58. PENINT1 ^a	0.02	-0.01	0.08	-0.02	0.05	0.05	0.03	0.01	0.01	0.05	0.02	0.01	-0.01	-0.03	0.04
59. PENINT2 ^a	0.07	-0.04	-0.11	-0.18*	0.02	-0.02	0.16*	0.13*	0.05	0.01	-0.05	0.08	0.05	-0.01	-0.02
60. PENINT3 ^a	-0.05	-0.16*	-0.23*	-0.23*	-0.02	-0.07	-0.02	0.00	-0.06	-0.09	-0.09	-0.08	-0.07	-0.12	-0.16*
61. PENINT4 ^a	-0.03	-0.12	-0.20*	-0.26*	0.01	-0.06	0.03	0.02	-0.00	-0.08	-0.08	-0.05	-0.08	-0.09	-0.14*
62. PENINT5 ^a	-0.05	-0.12	-0.16*	-0.24*	-0.05	-0.07	-0.00	-0.00	-0.03	-0.13*	-0.05	-0.06	-0.11	-0.12	-0.14*
63. PENINT6 ^a	-0.11	-0.17*	-0.14*	-0.21	-0.01	-0.07	-0.04	-0.06	-0.03	-0.15*	-0.11	-0.14*	-0.13*	-0.13*	-0.15*
64. IMOT	0.12	0.18*	0.20*	0.22*	0.41*	0.45*	0.43*	0.50*	0.50*	0.39*	0.42*	0.48*	0.50*	0.51*	0.20*
65. TMOT	0.14*	0.11	0.15*	0.17*	0.29*	0.29*	0.38*	0.44*	0.46*	0.29*	0.29*	0.40*	0.45*	0.45*	0.10
66. WITHDRW	-0.13*	-0.09	-0.10	-0.09	-0.28*	-0.31*	-0.34*	-0.38*	-0.34*	-0.35*	-0.33*	-0.38*	-0.42*	-0.44*	-0.16*
Variable	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1. INDFB ^a	0.15	0.04	-0.01	-0.03	-0.13	-0.09	0.05	-0.02	-0.11	-0.02	-0.04	-0.03	-0.00	0.07	-0.00
2. TMFB ^a	0.22*	0.14	0.22*	0.22*	-0.15	-0.07	0.08	0.05	-0.02	0.10	0.11	0.09	0.21	-0.02	-0.16
3. COGABIL	-0.06	0.20	0.20	0.12	-0.09	-0.21*	0.02	0.21*	0.10	0.17	0.12	0.24*	-0.00	-0.19	-0.18

Table 5 (Cont'd).

Variable	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
4. SEFFT1	0.38*	0.40*	0.44*	0.37*	-0.32*	-0.36*	0.17	0.33*	0.27*	0.24*	0.27*	0.27*	0.17	-0.24*	-0.27*
5. SEFFT2	0.52*	0.52*	0.46*	0.39*	-0.32*	-0.40*	0.15	0.27*	0.44*	0.32*	0.28*	0.30*	0.14	-0.33*	-0.31*
6. SEFFT3	0.48*	0.47*	0.43*	0.33*	-0.33*	-0.38*	0.11	0.19	0.74*	0.64*	0.57*	0.49*	0.33*	-0.52*	-0.53*
7. SEFFT4	0.35*	0.37*	0.38*	0.20	-0.07	-0.24*	0.21	0.21	0.85*	0.82*	0.63*	0.51*	0.41*	-0.44*	-0.46*
8. PTEFFT1	0.58*	0.29*	0.37*	0.40*	-0.36*	-0.43*	0.23*	0.46*	0.23*	0.32*	0.16	0.15	0.21	-0.28*	-0.30*
9. PTEFFT2	0.70*	0.48*	0.47*	0.47*	-0.39*	-0.50*	0.27*	0.50*	0.31*	0.34*	0.24*	0.23*	0.19	-0.34*	-0.35*
10. PTEFFT3	0.58*	0.41*	0.45*	0.48*	-0.40*	-0.47*	0.23*	0.37*	0.64*	0.70*	0.47*	0.44*	0.40*	-0.51*	-0.57*
11. PTEFFT4	0.48*	0.34*	0.40*	0.36*	-0.17	-0.32*	0.27*	0.33*	0.72*	0.83*	0.56*	0.44*	0.44*	-0.42*	-0.47*
12. IGOAL1	0.35*	0.38*	0.42*	0.34*	-0.11	-0.18	0.18	0.35*	0.21*	0.22*	0.29*	0.13	0.28*	-0.13	-0.17
13. IGOAL2	0.42*	0.36*	0.37*	0.28*	-0.05	-0.15	0.21*	0.32*	0.26*	0.22*	0.20	0.03	0.14	-0.15	-0.13
14. IGOAL3	0.41*	0.32*	0.37*	0.34*	-0.12	-0.15	0.14	0.25*	0.20*	0.20	0.21*	0.04	0.26*	-0.17	-0.22*
15. IGOAL4	0.28*	0.28*	0.31*	0.25*	0.12	-0.01	0.14	0.24*	0.30*	0.29*	0.37*	0.15	0.28*	-0.10	-0.11
16. TGOAL1	0.39*	0.15	0.33*	0.21	0.00	-0.18	0.24*	0.32*	0.12	0.13	0.08	-0.03	0.16	0.02	-0.02
17. TGOAL2	0.48*	0.32*	0.42*	0.26*	-0.09	-0.31*	0.30*	0.38*	0.20	0.21*	0.11	-0.00	0.10	-0.09	-0.08
18. TGOAL3	0.51*	0.31*	0.39*	0.37*	-0.13	-0.33*	0.22*	0.39*	0.29*	0.36*	0.18	0.05	0.23*	-0.10	-0.22*
19. TGOAL4	0.48*	0.36*	0.44*	0.31*	0.04	-0.24*	0.32*	0.41*	0.43*	0.53*	0.39*	0.22*	0.25*	-0.13	-0.21
20. IGC1	0.16	0.21*	0.28*	0.28*	0.05	-0.08	0.12	0.33*	0.10	0.14	0.17	0.06	0.21	-0.02	-0.05
21. IGC2	0.43*	0.31*	0.32*	0.48*	-0.01	-0.25*	0.23*	0.48*	0.33*	0.37*	0.24*	0.11	0.43*	-0.30*	-0.26*
22. IGC3	0.44*	0.21	0.29*	0.54*	-0.20	-0.33*	0.27*	0.49*	0.24*	0.27*	0.26*	0.14	0.58*	-0.25*	-0.24*
23. IGC4	0.41*	0.17	0.28*	0.47*	-0.08	-0.23*	0.31*	0.49*	0.42*	0.45*	0.38*	0.22*	0.63*	-0.30*	-0.27*
24. IGC FN	0.47*	0.39*	0.39*	0.51*	-0.22*	-0.39*	0.36*	0.47*	0.46*	0.48	0.39*	0.30*	0.61*	-0.36*	-0.32*
25. TGC1	0.31*	0.20	0.43*	0.32*	0.03	-0.25*	0.28*	0.43*	0.18	0.29*	0.15	0.10	0.31*	-0.17	-0.21
26. TGC2	0.53*	0.25*	0.35*	0.47*	-0.07	-0.35*	0.36*	0.59*	0.29*	0.38*	0.17	0.05	0.41*	-0.27*	-0.26*
27. TGC3	0.44*	0.23*	0.31*	0.49*	-0.17	-0.36*	0.42*	0.58*	0.35*	0.45*	0.35*	0.22*	0.57*	-0.28*	-0.33*
28. TGC4	0.40*	0.31*	0.40*	0.47*	-0.01	-0.24*	0.48*	0.60*	0.47*	0.55*	0.43*	0.25*	0.59*	-0.27*	-0.29*
29. TGC FN	0.42*	0.41*	0.47*	0.51*	-0.19	-0.40*	0.45*	0.57*	0.43*	0.53*	0.46*	0.37*	0.62*	-0.36*	-0.35*
30. SEFFD1	0.75*	0.59*	0.49*	0.45*	-0.41*	-0.43*	0.07	0.16	0.42*	0.33*	0.37*	0.34*	0.21	-0.39*	-0.38*

Table 5 (Cont'd).

Variable	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
31. PTEFFD1	(0.95)	0.56*	0.56*	0.64*	-0.52*	-0.59*	0.26*	0.46*	0.30*	0.38	0.28*	0.25*	0.33*	-0.43*	-0.49*
32. RLCLD1	0.31*	(0.87)	0.76*	0.51*	-0.34*	-0.41*	0.23*	0.30*	0.42*	0.43*	0.54*	0.54*	0.24*	-0.39*	-0.42*
33. IPCD1	0.21*	0.66*	(0.87)	0.54*	-0.38*	-0.50*	0.33*	0.40*	0.37*	0.41*	0.43*	0.51*	0.25*	-0.42*	-0.48*
34. SATISD1	0.48*	0.42*	0.39*	(0.83)	-0.57*	-0.64*	0.35*	0.59*	0.22*	0.34*	0.29*	0.39*	0.60*	-0.47*	-0.55*
35. IFRUSD1	-0.33*	-0.23*	-0.26*	-0.44*	(0.74)	0.76*	-0.15	-0.29*	-0.07	-0.15	-0.06	-0.31*	-0.18	0.56*	0.59*
36. TFRUSD1	-0.45*	-0.23*	-0.23*	-0.43*	0.66	(0.77)	-0.28*	-0.46*	-0.23*	-0.34*	-0.21	-0.37*	-0.33*	0.59*	0.62*
37. SOCCOHD1	0.17*	0.09	0.18*	0.31*	-0.18*	-0.22*	(0.65)	0.56*	0.13	0.21	0.19	0.06	0.21	-0.23*	-0.24*
38. TSKCOHD1	0.35*	0.22*	0.25*	0.46*	-0.19*	-0.30*	0.34*	(0.56)	0.17	0.30*	0.29*	0.29*	0.41*	-0.31*	-0.33*
39. SEFFD2	0.38*	0.32*	0.20*	0.17*	-0.08	-0.18*	0.13*	0.23*	(0.94)	0.87*	0.64*	0.56*	0.43*	-0.39*	-0.37*
40. PTEFFD2	0.45*	0.27*	0.17*	0.19*	-0.12	-0.29*	0.17*	0.19*	0.84*	(0.94)	0.64*	0.57*	0.53*	-0.44*	-0.46*
41. RLCLD2	0.22*	0.54*	0.43*	0.29*	-0.06	-0.15*	0.15*	0.22*	0.48*	0.45*	(0.87)	0.77*	0.55*	-0.46*	-0.44*
42. IPCD2	0.13*	0.46*	0.51*	0.30*	-0.24*	-0.27*	0.05	0.17*	0.37*	0.37*	0.68*	(0.87)	0.48*	-0.43*	-0.46*
43. SATISD2	0.29*	0.19*	0.14*	0.63*	-0.13*	-0.24*	0.18*	0.34*	0.22*	0.30*	0.41*	0.33*	(0.88)	-0.40*	-0.48*
44. IFRUSD2	-0.30*	-0.30*	-0.28*	-0.35*	0.47*	0.51*	-0.17*	-0.19*	-0.29*	-0.30*	-0.35*	-0.31*	-0.33*	(0.76)	0.84*
45. TFRUSD2	-0.31*	-0.28*	-0.26*	-0.33*	0.46*	0.53*	-0.16*	-0.20*	-0.24*	-0.35*	-0.30*	-0.34*	-0.32*	0.72*	(0.73)
46. SOCCOHD2	0.08	0.08	0.17*	0.22*	0.01	-0.14*	0.70*	0.28*	0.13*	0.15*	0.18*	0.11	0.24*	-0.12	-0.09
47. TSKCOHD2	0.18*	0.11	0.19*	0.29*	-0.07	-0.20*	0.41*	0.57*	0.19*	0.30*	0.31*	0.20*	0.40*	-0.27*	-0.26*
48. IDECKD2	-0.01	0.20*	0.16*	0.18*	-0.05	0.02	0.14*	0.02	0.16*	0.06*	0.19*	0.18*	0.13*	-0.18*	-0.03
49. TDECKD2	-0.15*	0.20*	0.21*	0.11	-0.06	0.05	0.11	0.01	0.00	-0.04	0.20*	0.19*	0.10	-0.20*	-0.09
50. COHERD2	-0.05	0.07	0.03	0.02	0.01	0.02	-0.02	-0.02	0.03	0.09	0.01	-0.02	0.06	-0.07	-0.06
51. SIMD2	0.04	0.18*	0.15*	0.18*	-0.01	-0.09	0.07	0.17*	0.11	0.12	0.31*	0.26*	0.22*	-0.08	-0.10
52. SCORE1 ^b	0.08	0.19*	0.15*	0.19*	-0.14*	-0.18*	0.09	0.06	0.08	0.09	0.19*	0.16*	0.05	-0.23*	-0.21*
53. SCORE2 ^b	0.15*	0.27*	0.23*	0.17*	-0.17*	-0.22*	0.13*	0.15*	0.19*	0.20*	0.18*	0.14*	0.07	-0.25*	-0.21*
54. SCORE3 ^b	0.25*	0.26*	0.24*	0.18*	-0.22*	-0.22*	0.10	0.09	0.12	0.16*	0.18*	0.10	0.03	-0.12	-0.22*
55. SCORE4 ^b	0.20*	0.24*	0.28*	0.15*	-0.12	-0.19*	0.08	0.04	0.19*	0.21*	0.20*	0.14*	0.08	-0.17*	-0.21*
56. SCORE5 ^b	0.14*	0.22*	0.26*	0.13*	-0.09	-0.17*	0.09	0.02	0.22*	0.22*	0.19*	0.14*	0.07	-0.11	-0.18*
57. SCORE6 ^b	0.18*	0.22*	0.24*	0.19*	-0.10	-0.17*	0.11	0.13*	0.21*	0.22*	0.20*	0.11	0.16*	-0.11	-0.17*

Table 5 (Cont'd).

Variable	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
58. PENINT1*	0.05	-0.05	-0.01	0.01	-0.03	0.01	-0.06	-0.03	-0.00	-0.03	-0.10	-0.05	-0.01	-0.02	0.01
59. PENINT2*	-0.10	-0.10	-0.08	-0.05	0.08	0.16*	-0.11	-0.12*	-0.08	-0.12	-0.05	-0.07	0.07	0.13*	0.17*
60. PENINT3*	-0.26*	-0.29*	-0.24*	-0.17*	0.20*	0.27*	-0.11	-0.22*	-0.08	-0.12	-0.14*	-0.20*	-0.00	0.16*	0.21*
61. PENINT4*	-0.17*	-0.24*	-0.19*	-0.07	0.06	0.15*	-0.02	-0.09	-0.09	-0.12*	-0.15*	-0.16*	-0.02	0.17*	0.20*
62. PENINT5*	-0.15*	-0.30*	-0.26*	-0.20*	0.05	0.17*	-0.10	-0.14*	-0.10	-0.15*	-0.23*	-0.26*	-0.11	0.22*	0.26*
63. PENINT6*	-0.22*	-0.21*	-0.26*	-0.24*	0.15*	0.22*	-0.16*	-0.27*	-0.08	-0.11	-0.14*	-0.22*	-0.12	0.19*	0.26*
64. IMOT	0.26*	0.19*	0.16*	0.37*	-0.02	-0.11	0.19*	0.29*	0.28*	0.28*	0.42*	0.30*	0.48*	-0.16*	-0.12*
65. TMOT	0.30*	0.13*	0.12	0.31*	-0.02	0.12	0.14*	0.32*	0.22*	0.29*	0.41*	0.29*	0.48*	-0.13*	-0.14*
66. WITHDRAW	-0.25*	-0.16*	-0.15*	-0.58*	-0.20*	0.19*	-0.31*	-0.30*	-0.17*	-0.20*	-0.29*	-0.22*	-0.59*	0.28*	0.20*

Variable	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1. INDFB*	0.00	-0.07	-0.12	-0.18	-0.07	-0.08	-0.03	-0.09	0.03	0.10	-0.03	-0.01	-0.06	0.09	-0.08
2. TMFB*	-0.02	0.07	-0.01	0.06	0.10	0.09	0.17	0.04	0.22*	0.22*	0.20	0.25*	0.06	-0.02	-0.08
3. COGABIL	0.10	0.05	0.44*	0.41*	0.25*	0.35*	0.46*	0.46*	0.26*	0.37*	0.39*	0.38*	-0.05	-0.29*	-0.43*
4. SEFFT1	0.17	0.08	0.19	0.07	0.07	0.23*	0.35*	0.28*	0.32*	0.22*	0.09	0.11	0.11	-0.15	-0.40*
5. SEFFT2	0.07	0.05	0.17	0.04	-0.07	0.18	0.13	0.32*	0.38*	0.26*	0.21	0.24*	0.14	-0.17	-0.32*
6. SEFFT3	0.08	0.20	0.17	0.07	-0.09	0.17	0.24*	0.28*	0.28*	0.25*	0.25*	0.21	0.06	-0.09	-0.18
7. SEFFT4	0.23*	0.33*	0.21	0.14	-0.00	0.12	0.20	0.31*	0.21	0.36*	0.31*	0.24*	0.03	-0.18	-0.21
8. PTEFFT1	0.20	0.15	0.21	0.05	0.09	0.21	0.15	0.26*	0.27*	0.22*	0.09	0.22*	0.11	-0.20	-0.39*
9. PTEFFT2	0.17	0.21	0.07	-0.04	0.01	0.11	0.08	0.39*	0.41*	0.26*	0.16	0.31*	0.16	-0.21*	-0.37*
10. PTEFFT3	0.29*	0.37*	0.10	0.09	0.08	0.14	0.20	0.24*	0.33*	0.27*	0.23*	0.32*	0.05	-0.13	-0.24*
11. PTEFFT4	0.35*	0.40*	0.17	0.19	0.09	0.08	0.23*	0.28*	0.27*	0.38*	0.25*	0.28*	0.04	-0.20	-0.28*
12. IGOAL1	0.19	0.30*	0.22*	0.04	0.03	0.39*	0.21*	0.13	0.23*	0.16	0.18	0.26*	0.01	0.00	-0.13
13. IGOAL2	0.13	0.17	0.17	0.06	0.02	0.24*	0.21	0.25*	0.29*	0.21*	0.20	0.30*	0.05	-0.05	-0.19
14. IGOAL3	0.01	0.21	-0.01	-0.02	0.03	0.11	0.19	0.20	0.34*	0.27*	0.23*	0.29*	0.19	0.02	-0.14
15. IGOAL4	0.06	0.18	0.08	0.08	0.07	0.23*	0.26*	0.28*	0.29*	0.36*	0.26*	0.31*	0.06	-0.04	-0.09
16. TGOAL1	0.32*	0.26*	0.13	-0.04	-0.03	0.21	0.10	0.01	0.10	0.08	0.11	0.13	0.04	0.10	-0.08

Table 5 (Cont'd).

Variable	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
17. TGOAL2	0.23*	0.16	0.09	-0.02	0.02	0.19	0.21*	0.29*	0.27*	0.20	0.19	0.30*	-0.02	-0.06	-0.23*
18. TGOAL3	0.16	0.19	0.02	-0.06	0.04	0.17	0.27*	0.37*	0.52*	0.40*	0.33*	0.31*	0.12	-0.18	-0.35*
19. TGOAL4	0.26*	0.26*	0.14	0.06	0.13	0.27*	0.35*	0.43*	0.48*	0.54*	0.46*	0.43*	-0.02	-0.27*	-0.33*
20. IGC1	0.27*	0.35*	0.13	0.10	0.05	0.30*	0.06	0.13	0.15	0.10	0.18	0.21	0.09	0.05	-0.04
21. IGC2	0.25*	0.48*	0.13	-0.04	0.01	0.21	0.10	0.23*	0.15	0.15	0.18	0.24*	0.09	-0.03	-0.13
22. IGC3	0.23*	0.49*	-0.01	-0.08	0.01	0.15	-0.02	-0.01	0.11	0.06	0.01	0.10	0.05	0.27*	-0.03
23. IGC4	0.26*	0.57*	0.01	-0.03	0.02	0.10	0.04	0.02	0.07	0.16	0.06	0.14	0.02	0.21	0.01
24. IGC FN	0.27*	0.53*	0.19	0.11	-0.00	0.24	0.15	0.13	0.13	0.22*	0.18	0.23*	0.02	0.08	-0.11
25. TGC1	0.44*	0.43*	0.14	0.03	0.16	0.30*	0.10	0.10	0.19	0.19	0.24*	0.24*	0.10	0.02	-0.17
26. TGC2	0.31*	0.47*	0.09	-0.03	0.08	0.09	0.08	0.29*	0.20	0.22*	0.17	0.27*	0.04	-0.09	-0.17
27. TGC3	0.41*	0.57*	0.00	0.00	0.09	0.14	0.13	0.12	0.18	0.19	0.11	0.18	0.01	0.13	-0.14
28. TGC4	0.45*	0.62*	0.09	0.06	0.10	0.15	0.11	0.16	0.14	0.25*	0.17	0.24*	-0.01	0.08	-0.11
29. TGC FN	0.41*	0.63*	0.21	0.18	0.19	0.28*	0.18	0.22*	0.22*	0.28*	0.24*	0.31*	-0.04	-0.02	-0.20
30. SEFFD1	-0.02	0.02	0.25*	0.01	-0.06	0.20	0.18	0.24*	0.44*	0.30*	0.22*	0.28*	0.06	-0.03	-0.26*
31. PTEFFD1	0.12	0.19	0.14	-0.03	0.01	0.05	0.15	0.27*	0.53*	0.34*	0.25*	0.34*	0.08	-0.14	-0.37*
32. RLCLD1	0.18	0.08	0.26*	0.12	0.02	0.26*	0.34*	0.43*	0.51*	0.41*	0.41*	0.44*	-0.07	-0.14	-0.42*
33. IPCD1	0.33*	0.22*	0.14	0.14	0.05	0.26*	0.36*	0.37*	0.48*	0.43*	0.43*	0.45*	-0.01	-0.14	-0.41*
34. SATISD1	0.27*	0.35*	0.13	0.01	0.08	0.25*	0.22*	0.28*	0.33*	0.27*	0.26*	0.34*	0.02	-0.08	-0.24*
35. IFRUSD1	0.02	-0.08	-0.05	-0.05	-0.04	-0.01	-0.26*	-0.21	-0.30*	-0.08	-0.03	-0.10	-0.04	0.13	0.31*
36. TFRUSD1	-0.18	-0.24*	-0.14	-0.03	-0.06	-0.12	-0.30*	-0.36*	-0.39*	-0.25*	-0.22*	-0.24*	0.01	0.22*	0.38*
37. SOCCOHD1	0.78*	0.46*	0.12	0.18	0.06	0.10	0.14	0.22*	0.15	0.20	0.21	0.24*	-0.09	-0.16	-0.15
38. TSKCOHD1	0.49*	0.61*	0.11	0.01	-0.00	0.25*	0.13	0.31*	0.27*	0.17	0.13	0.26*	-0.04	-0.18	-0.33*
39. SEFFD2	0.16	0.28*	0.21	0.04	0.08	0.18	0.16	0.28*	0.12	0.23*	0.26*	0.24*	-0.00	-0.13	-0.14
40. PTEFFD2	0.25*	0.41*	0.16	0.06	0.16	0.19	0.19	0.27*	0.20	0.30*	0.32*	0.31*	-0.05	-0.18	-0.18
41. RLCLD2	0.20	0.43*	0.31*	0.19	0.05	0.43*	0.26*	0.27*	0.21	0.29*	0.28*	0.33*	-0.14	-0.07	-0.20
42. IPCD2	0.15	0.31*	0.23*	0.12	0.03	0.36*	0.30*	0.24*	0.14	0.26*	0.28*	0.25*	-0.07	-0.10	-0.28*
43. SATISD2	0.24*	0.55*	0.11	0.03	0.14	0.32*	0.01	0.03	0.07	0.15	0.17	0.24*	-0.02	0.10	-0.01

Table 5 (Cont'd).

Variable	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
44. IFRUSD2	-0.13	-0.35*	-0.30*	-0.24*	-0.09	-0.12	-0.29*	-0.33*	-0.29*	-0.31*	-0.28*	-0.27	-0.03	0.19	0.24*
45. TFRUSD2	-0.20	-0.40*	-0.21	-0.14	-0.06	-0.14	-0.35*	-0.26*	-0.36*	-0.34*	-0.36*	-0.32*	0.02	0.25*	0.31*
46. SOCCOHD2	(0.71)	0.47*	0.10	0.19	0.05	0.13	0.06	0.07	0.06	0.18	0.24*	0.22*	0.00	-0.04	-0.15
47. TSKCOHD2	0.41*	(0.65)	0.07	-0.02	0.16	0.31*	0.08	0.04	-0.03	0.04	0.12	0.18	-0.02	-0.01	0.02
48. IDECKD2	0.14*	0.08	(0.60)	0.57*	0.25*	0.35*	0.31*	0.37*	0.24*	0.37*	0.31*	0.27*	-0.03	-0.24*	-0.37*
49. TDECKD2	0.12	0.04	0.48*	(0.65)	0.36*	0.30*	0.38*	0.34*	0.18	0.32*	0.09	0.13	-0.05	-0.29*	-0.29*
50. COHERD2	-0.05	0.09	0.21*	0.26*	(0.65)	0.26*	0.23*	0.25*	0.21	0.18	0.17	0.24*	-0.08	-0.20	-0.21
51. SIMD2	0.10	0.22*	0.23*	0.20*	0.15*	(0.65)	0.23*	0.16	0.12	0.13	0.16	0.26*	-0.22*	-0.13	-0.12
52. SCORE1 ^b	0.06	0.05	0.22*	0.19*	0.07	0.18*	(1.00)	0.63*	0.43*	0.49*	0.38*	0.30*	-0.10	-0.46*	-0.50*
53. SCORE2 ^b	0.02	0.04	0.24*	0.20*	0.18*	0.16*	0.50*	(1.00)	0.62*	0.55*	0.40*	0.37*	0.05	-0.61*	-0.56*
54. SCORE3 ^b	0.05	0.02	0.10	0.09	0.09	0.11	0.31*	0.62*	(1.00)	0.73*	0.55*	0.54*	0.09	-0.42*	-0.62*
55. SCORE4 ^b	0.07	0.05	0.20*	0.17*	0.21*	0.09	0.30*	0.51*	0.74*	(1.00)	0.77*	0.68*	0.09	-0.31*	-0.53*
56. SCORE5 ^b	0.11	0.06	0.15*	0.08	0.17*	0.09	0.25*	0.43*	0.66*	0.85*	(1.00)	0.74*	0.00	-0.23*	-0.42*
57. SCORE6 ^b	0.15*	0.14*	0.13*	0.11	0.18*	0.16*	0.19*	0.40*	0.62*	0.73*	0.81*	(1.00)	-0.04	-0.08	-0.39*
58. PENINT1 ^a	0.00	-0.02	-0.02	-0.03	-0.04	-0.22*	-0.09	0.00	0.06	0.06	-0.00	-0.03	(1.00)	0.08	-0.03
59. PENINT2 ^a	-0.02	-0.00	-0.15*	-0.19*	-0.12	-0.13*	-0.36*	-0.48*	-0.28*	-0.21*	-0.15*	-0.05	0.08	(1.00)	0.43*
60. PENINT3 ^a	-0.11	0.02	-0.23*	-0.19*	-0.13*	-0.12	-0.39*	-0.46*	-0.44*	-0.36*	-0.27*	-0.24*	-0.03	0.43*	(1.00)
61. PENINT4 ^a	-0.02	0.00	-0.24*	-0.18*	-0.19*	-0.18*	-0.38*	-0.47*	-0.47*	-0.46*	-0.35*	-0.31*	-0.05	0.36*	0.63*
62. PENINT5 ^a	-0.11	-0.02	-0.27*	-0.16*	-0.11	-0.27*	-0.34*	-0.42*	-0.39*	-0.48*	-0.43*	-0.38*	-0.01	0.21*	0.51*
63. PENINT6 ^a	-0.16*	-0.10	-0.18*	-0.15*	-0.13*	-0.22*	-0.36*	-0.34*	-0.42*	-0.40*	-0.31*	-0.37*	0.03	0.22*	0.56*
64. IMOT	0.19*	0.40*	0.12	0.10	0.08	0.29*	0.07	0.16*	0.17*	0.16	0.12	0.20*	-0.01	0.08	-0.06
65. TMOT	0.13*	0.41*	0.08	0.12	0.10	0.31*	0.07	0.13*	0.14*	0.12	0.04	0.18*	-0.04	0.09	-0.06
66. WITHDRW	-0.29*	-0.32*	-0.19*	-0.15*	-0.10	-0.21*	-0.03	-0.08	-0.11	-0.10	-0.07	-0.17*	-0.07	-0.05	0.05

Variable	61	62	63	64	65	66
1. INDFB ^a	-0.07	-0.06	0.00	-0.07	0.09	-0.05
2. TMFB ^a	-0.14	-0.20	-0.17	0.22*	0.20	-0.18
3. COGABIL	-0.46*	-0.45*	-0.40*	-0.02	-0.03	-0.04

Table 5 (Cont'd).

Variable	61	62	63	64	65	66
4. SEFFT1	-0.22*	-0.26*	-0.34*	0.19	0.15	-0.30*
5. SEFFT2	-0.22*	-0.26*	-0.28*	0.29*	0.14	-0.18
6. SEFFT3	-0.21	-0.23*	-0.19	0.32*	0.26*	-0.30*
7. SEFFT4	-0.19	-0.21	-0.19	0.34*	0.32*	-0.31*
8. PTEFFT1	-0.23*	-0.23*	-0.33*	0.32*	0.39*	-0.33*
9. PTEFFT2	-0.28*	-0.27*	-0.34*	0.39*	0.35*	-0.19
10. PTEFFT3	-0.26*	-0.26*	-0.37*	0.39*	0.40*	-0.42*
11. PTEFFT4	-0.22*	-0.20	-0.29*	0.45*	0.47*	-0.41*
12. IGOAL1	-0.06	-0.19	-0.22*	0.33*	0.24*	-0.34*
13. IGOAL2	-0.14	-0.18	-0.19	0.30*	0.22	-0.15
14. IGOAL3	-0.14	-0.16	-0.13	0.23*	0.20	-0.20*
15. IGOAL4	-0.17	-0.23	-0.15	0.32*	0.29*	-0.27*
16. TGOAL1	-0.05	-0.09	-0.17	0.25*	0.24*	-0.25*
17. TGOAL2	-0.18	-0.18	-0.25*	0.33*	0.25*	-0.11
18. TGOAL3	-0.30*	-0.24*	-0.20	0.33*	0.23*	-0.19
19. TGOAL4	-0.36*	-0.35*	-0.30*	0.38*	0.29*	-0.22*
20. IGC1	0.02	-0.09	-0.02	0.34*	0.29*	-0.22*
21. IGC2	-0.11	-0.13	-0.14	0.48*	0.38*	-0.34*
22. IGC3	0.05	0.00	-0.08	0.53*	0.50*	-0.52*
23. IGC4	0.03	-0.01	-0.11	0.61*	0.55*	-0.54*
24. IGC FN	-0.00	-0.06	-0.05	0.55*	0.49*	-0.54*
25. TGC1	-0.14	-0.24*	-0.27*	0.39*	0.36*	-0.40*
26. TGC2	-0.15	-0.09	-0.20	0.46*	0.41*	-0.36*
27. TGC3	-0.09	-0.10	-0.23*	0.59*	0.52*	-0.49*
28. TGC4	-0.13	-0.17	-0.22*	0.59*	0.53*	-0.52*
29. TGC FN	-0.15	-0.20	-0.22*	0.56*	0.51*	-0.51*
30. SEFFD1	-0.21	-0.22	-0.23*	0.28*	0.25*	-0.23*
31. PTEFFD1	-0.24*	-0.22*	-0.31*	0.40*	0.40*	-0.35*

Table 5 (Cont'd).

Variable	61	62	63	64	65	66
32. RLCLD1	-0.35*	-0.44*	-0.31*	0.24*	0.23*	-0.23*
33. IPCD1	-0.32*	-0.44*	-0.43*	0.27*	0.28*	-0.29*
34. SATISD1	-0.09	-0.28*	-0.34*	0.43*	0.39*	-0.62*
35. IFRUSD1	0.09	0.07	0.22*	-0.11	-0.14	0.24*
36. TFRUSD1	0.20	0.23*	0.30*	-0.25*	-0.21	0.33*
37. SOCCOHD1	-0.02	-0.14	-0.21	0.30*	0.21	-0.33*
38. TSKCOHD1	-0.13	-0.21	-0.40*	0.47*	0.42*	-0.44*
39. SEFFD2	-0.15	-0.16	-0.13	0.41*	0.33*	-0.30*
40. PTEFFD2	-0.19	-0.23*	-0.17	0.46*	0.43*	-0.40*
41. RLCLD2	-0.21	-0.33*	-0.19	0.57*	0.54*	-0.42*
42. IPCD2	-0.22*	-0.36*	-0.31*	0.34*	0.36*	-0.30*
43. SATISD2	-0.02	-0.16	-0.17	0.62*	0.61*	-0.69*
44. IFRUSD2	0.24*	0.32*	0.29*	-0.31*	-0.26*	0.31*
45. TFRUSD2	0.30*	0.39*	0.38*	-0.31*	-0.27*	0.31*
46. SOCCOHD2	-0.03	-0.14	-0.23*	0.27	0.21	-0.30*
47. TSKCOHD2	0.01	-0.03	-0.13	0.56*	0.51*	-0.38*
48. IDECKD2	-0.37*	-0.42*	-0.29*	0.11	0.08	-0.15
49. TDECKD2	-0.28*	-0.25*	-0.23*	0.03	0.11	-0.05
50. COHERD2	-0.32*	-0.19	-0.23*	0.09	0.16*	-0.17
51. SIMD2	-0.18	-0.27*	-0.22*	0.42*	0.40*	-0.30*
52. SCORE1 ^b	-0.50*	-0.44*	-0.46*	0.11	0.12	-0.01
53. SCORE2 ^b	-0.55*	-0.48*	-0.42*	0.13	0.09	-0.07
54. SCORE3 ^b	-0.62*	-0.50*	-0.57*	0.23*	0.17	-0.18
55. SCORE4 ^b	-0.69*	-0.67*	-0.58*	0.26*	0.23*	-0.20
56. SCORE5 ^b	-0.53*	-0.68*	-0.50	0.15	0.10	-0.16
57. SCORE6 ^b	-0.50*	-0.62*	-0.61*	0.34*	0.35*	-0.33*

Table 5 (Cont'd).

Variable	61	62	63	64	65	66
58. PENINT1 ^a	-0.05	-0.01	0.03	-0.02	-0.05	-0.10
59. PENINT2 ^a	0.36*	0.21	0.22*	0.12	0.12	-0.07
60. PENINT3 ^a	0.63*	0.51*	0.56*	-0.09	-0.08	0.07
61. PENINT4 ^a	(1.00)	0.77*	0.65*	-0.10	-0.11	-0.01
62. PENINT5 ^a	0.77*	(1.00)	0.71*	-0.17	-0.15	0.19
63. PENINT6 ^a	0.65*	0.71*	(1.00)	-0.22*	-0.26*	0.26*
64. IMOT	-0.07	-0.12	-0.15*	(0.82)	0.85*	-0.55*
65. TMOT	-0.09	-0.12	-0.20*	0.80*	(0.91)	-0.56*
66. WITHDRW	-0.01	0.13	0.18*	-0.44*	-0.42*	(0.83)

* $p \leq .05$ (2-tailed)

Notes.

Pairwise elimination used for computing correlations.

Reliabilities (alphas) on the diagonal calculated using total sample.

Correlations have to be interpreted with caution due to multiple levels of analysis.

Team level correlations are in italics above the diagonal, and individual level correlations are below the diagonal.

Except for individual feedback, team feedback, scores, and penalty intrusions, all team level variables were created by computing the means of the individual level variables in a given team.

^a True team level variables are those which are constant across members of a given team. The same value is assigned to all individuals of a given team for true team level variables.

^b Score is not the same variable at the individual and team level. Scores for team level correlations are the team scores for team performance as a unit. Scores for individual level correlations are the scores for individual position performance. Means of scores for teams shown under the mean column. Means of scores for individual positions shown in parentheses.

has not been demonstrated (James, 1982). Similarly, the correlations computed using individual level scores may be problematic because they ignore the intercorrelations among members of the same team. The intercorrelations among members will influence the size of the correlations obtained as well as the significance tests associated with them (Kenny & La Voie, 1985; Pedhazur, 1982).

Several points should be made regarding the descriptive statistics and correlations. First, some of the variables have variances that are large and increasing over time. This does not pose any particular problem except in analyses that attempt to evaluate changes over time. In these cases, transformations of the dependent variables were employed in addition to analyzing the original scores to ensure violations of homogeneity of covariance matrices did not create any problems. Also, comparisons were made across conditions to ensure that homogeneity of variance across treatments was tenable.

Second, the correlations at both the individual and team level of analyses were generally similar in magnitude and pattern. For example, the correlations between self-efficacy (SEFF) and personal team-efficacy (PTEFF) at the team level for each of the four training measurements was .67, .77, .78, and .85. The same correlations at the individual level, ignoring team membership were .57, .65, .73, and .75. Similarly, the correlations between individual goals (INDGLS) and scores were .21, .25, .34, and .35 at the team level. The same correlations were .15, .13, .28, and .26 at the individual level. Although the individual level correlations were smaller (approximately .088 less on average for these eight correlations), the overall patterns and magnitudes were fairly similar. There were exceptions, but generally speaking, analyses conducted at one level of analysis were highly likely to be mirrored in analyses conducted at another level.

The fact that the general patterns were similar suggests the likelihood of aggregation bias is minimized. It also suggests that processes of regulation and learning unfolding within individuals was similar within and across teams, and regardless of the level of statistical analysis, similar conclusions regarding effect sizes are likely to be drawn. Nevertheless, for the sake of thoroughness, when appropriate, multiple approaches to testing a particular hypothesis at different levels were employed.

Analytical Approaches

Repeated measures regression. Repeated measures regression (RMR) was the primary technique used for testing hypotheses in the current study. The specific form of RMR employed was the one initially proposed by Cohen and Cohen (1983). This approach was further elaborated by Hollenbeck et al. (1994) and Gully (1994). In a repeated measures regression analysis, the variance in the dependent variable is partitioned into between and within-teams variance. The resulting F tests for the regressions are then adjusted to reflect the increment in R^2 as a function of whether the effect is a between team or within-team (member) effect.

There are a number of advantages of the RMR approach. First, it effectively uses the degrees of freedom available from having multiple observations of members within a team. Second, the power of the F test is usually increased by partitioning variance relevant to different levels. Third, it provides opportunities to use continuous independent variables without dichotomizing measures. Finally, it allows one to use more familiar regression-based techniques to test hypotheses about effects while taking into account different levels of analysis. For example, it is relatively easy to determine the incremental contribution of a variable for prediction after controlling for other variables at different levels of analysis.

The first disadvantage of RMR is that it depends on equal observations over time for all members of all teams. This required the elimination of all teams from the analyses which did not attend both sessions or which did not perform all trials. This created a loss in power and a potential biasing effect if there was nonsystematic attrition. A second disadvantage of RMR is that it is insufficiently developed for more than two levels of analysis. The final potential disadvantage is that RMR results are based on a number of statistical assumptions, several of which may not be tenable (e.g., team and individual errors are uncorrelated; covariance matrices are homogenous). In order to address some of these issues, alternative modeling techniques were employed to verify RMR findings.

Hierarchical linear modeling. Although the logic behind hierarchical linear modeling (HLM), repeated measures ANOVA, and repeated measures regression (RMR) is not identical, all three approaches are quite similar (Gully, 1997). Multilevel regression models like HLM are sophisticated extensions of the more familiar ANOVA and multiple regression approaches (Kreft, 1995; Hox, 1994). Fundamentally, each of these techniques partitions variance into different portions that correspond to higher (between units) and lower (within units) levels of analysis. They can then account for variance in these portions by using higher and lower level variables along with their interactions, to predict outcomes (e.g., slopes and intercepts) at these different levels of analysis.

Primary differences between HLM and other more common techniques involve the nature of variables potentially included in the model, treatment of random and fixed effects, estimation procedures, weighting procedures, error terms, and capability to deal with unbalanced data. Both repeated measures ANOVA and RMR approaches use least squares estimation techniques, whereas HLM uses maximum likelihood techniques. Both

RMR and HLM approaches can deal with continuous data, whereas dealing with continuous data is problematic with any ANOVA-based model. HLM can deal with unbalanced data whereas RMR can only be used with a balanced data design or estimation of variance components becomes problematic.

There are three primary advantages of HLM over RMR analyses. First, HLM can estimate effects for unbalanced data using the EM algorithm (Dempster, Laird, & Rubin, 1977) and by using precision weighted estimates of effects (Bryk & Raudenbush, 1992). Second, it provides estimation of complex error terms, which avoids the potentially problematic assumptions of RMR. Finally, HLM can be employed with more than three levels of analysis (Bryk & Raudenbush, 1992). This is particularly useful when investigating the effects of trials over time within individuals within teams.

The HLM analysis proceeded as follows. First, HLM was used to determine the variance components at different levels of analysis. A random ANOVA with no predictors in the model was performed to determine the relative contributions of within member, member, and team effects on the dependent variables of interest. Next, a slope plus intercept only model was performed with no predictors at the second (person or team) or third (team) levels of analysis. Appropriate fixing of effects was performed at this point, followed by the addition of level two predictors. This captured information regarding the impact of level two variables on the dependent variable. Again, the model was examined for fixing of effects. If effects at a third level were included, then the level two model was followed by the addition of level three predictors (team level effects). This model evaluated the cross-level impact of team level variables on lower level outcomes. This pattern of systematic model fitting is consistent with the approach suggested by Bryk and

Raudenbush (1992). The initial analyses were performed using grand mean centering. The entire set of analyses were repeated using the centering techniques suggested by Hofmann and Gavin (1996) to disentangle the group by group interactions from the cross-level interactions. Findings were highly similar for both grand mean centering and group mean centering approaches (with the inclusion of between variance for the group mean centered variables in the model).

Although HLM is quite flexible, there are several limitations to the HLM approach that were best addressed by RMR techniques. First, HLM is based on asymptotic distribution theory and it can “over shrink” estimates when using precision weighted estimation (Gully, 1997). Second, HLM was less effective in the analysis of incremental or interactive effects. For example, although they can be computed by hand, there are no significance tests readily available for the addition of blocks of variables to a multilevel model. This can create difficulties when trying to evaluate the incremental contribution of one set of variables over another. These same analyses are much more easily performed using RMR techniques. The third limitation is the difficulty in testing main effects when interaction terms are included. Because HLM is a full model fitting technique and incremental tests are not readily available, main effects are tested at the same time that interaction effects are tested. However, significance tests for main effects are not scale invariant when interaction terms are included in the model (Aiken & West, 1991), making the interpretation of main effects potentially problematic.

Multivariate multiple regression. Multivariate multiple regression (MVMR) is a multivariate analog of regular multiple regression (Stevens, 1992). In MVMR, one has

multiple dependent variables which are fitted against multiple independent variables. Thus, one can perform a significance test of higher level team effects on the three member values treated as three dependent variables. MVMR is a technique that is highly related to MANOVA and canonical correlational techniques. Linear combinations of the dependent and independent variables are created to maximize the shared variance. The linear combinations of dependent variables are then regressed on the linear combinations of independent variables and evaluated for strength of association. The primary advantage of the MVMR approach is that it provides a simultaneous test of the effects of all independent variables on dependent variables. Thus, whenever appropriate, MVMR was used to provide an omnibus test of effects and by providing an alternative test for particular RMR findings.

Repeated measures MANOVA. Repeated measures MANOVA procedures were also employed to test for the effects of manipulated independent variables on individual level dependent variables. This approach treats the multiple member dependent variables as nested within teams and treatments. The MANOVA procedures transform the covariance matrices of dependent variables to sphericity, eliminating violations of these assumptions (SPSS, 1988). Thus, MANOVA procedures provide an alternative test of RMR findings. Additionally, the MANOVA procedure was used to minimize Type I error associated with conducting repeated tests on multiple dependent variables and to take into consideration interrelationships among the dependent variables of interest.

Alternative techniques. There are a number of alternative strategies for testing multilevel effects, including aggregation approaches (Bliese, Halverson, & Rothberg, 1994; James, Demaree, & Wolf, 1984; Kozlowski & Hattrup, 1992) and Within-and-

Between-Analysis (WABA; Dansereau, Alutto, & Yammarino, 1984). The analytical techniques employed in the current study were selected over aggregation approaches and WABA for a number of reasons. Aggregation procedures are limited in their ability to address situations in which mean levels are not of interest. For example, it makes little sense to examine whether cognitive ability scores with a team are in agreement, eliminating the possibility of aggregating to a higher level. If one keeps the data at a lower level, it is not immediately clear how one would use aggregation approaches to analyze data at multiple levels of analysis. WABA is problematic because it is not clear how one would engage in incremental tests of prediction and it is difficult to estimate interaction effects with this approach.

RMR, HLM, MVMR, and MANOVA were selected as most appropriate for analyses because they each can address the issue of effects at multiple levels of analysis while retaining data at a lower level of analysis in different ways. These techniques also provide the capability to test for interactions or they provide alternative tests which meet particular assumptions of the statistical tests. HLM was particularly useful because it is also able to efficiently deal with unbalanced data at any given level by using the EM algorithm to estimate covariance components for incomplete data and by using precision weighted estimates in the analyses (Bryk & Raudenbush, 1992).

Effects of Training Outcomes on Performance Adaptability

Hypothesis 1 stated that declarative knowledge, structural knowledge, skills, and affect/attitudes would all be significantly and positively related to performance adaptability. The first analysis consisted of computing correlations between performance adaptability and individual and team declarative knowledge, coherence of knowledge

structures, similarity of knowledge structures among team members, previous skill, SEFF, PTEFF, satisfaction, and cohesion at the individual and team levels. The correlations are presented in Table 6. Each of the training outcomes was significantly and positively related to performance adaptability as measured by either score or lack of penalty intrusions. Also, the knowledge variables seemed to be more strongly related to penalty circle intrusions than were the affective variables.

The initial correlational analysis does not test the usefulness of the entire block of variables for understanding both dimensions of performance adaptability simultaneously. The initial analysis was followed by a MVMR in which performance adaptability score and penalty intrusions for all three positions (6 DVs) were regressed on all of the predictors simultaneously. The test of significance is presented at the bottom of Table 6; it indicates that the entire set of training outcomes significantly predicted performance adaptability. The two sets of analyses together suggest that the training outcomes as a block were significantly related to performance adaptability and provides strong support for H1. Follow up tests of specific hypotheses determined which of the variables were most strongly related to performance adaptability.

The next set of analyses were designed to determine the specific effects of individual training outcomes on performance adaptability. Hypothesis 1a suggested individual level training outcomes were positively related to performance adaptability. A series of RMR analyses partitioned the variance in a theoretically meaningful fashion to evaluate the incremental usefulness of training outcomes for understanding performance adaptability. First, previous performance or ability was entered to control for skill, followed by individual declarative knowledge. Individual declarative knowledge was

Table 6.

Relationship Between Training Outcomes and Performance Adaptability

	Individual Level		Team Level	
	<u>Score</u>	<u>Penalty Intrusions</u>	<u>Score</u>	<u>Penalty Intrusions</u>
Ind Declar Knowledge	.13*	-.18*	.27*	-.29*
Team Declar Knowledge	.11+	-.15*	.13	-.23*
Coherence of Know Struct	.18*	-.13*	.24*	-.23*
Similarity of Know Struct	.16*	-.22*	.26*	-.22*
Previous skill	.81*	-.31*	.74*	-.50*
Self-Efficacy	.21*	-.08	.24*	-.13
Personal Team-Efficacy	.22*	-.11+	.31*	-.17+
Satisfaction	.16*	-.12+	.24*	-.17+
Social Cohesion	.15*	-.16*	.22*	-.23*
Task Cohesion	.14*	-.10	.18+	-.13

Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	2.95	4.39	120.00	188.00	.000*
Hotellings	16.16	5.72	120.00	170.00	.000*
Wilks	.00265	5.10	120.00	177.53	.000*
Roys	.883				

Note: * indicates $p \leq .05$, two-tailed

+ indicates $p \leq .05$, one-tailed

followed by the entry of coherence of structural knowledge. Finally, satisfaction and SEFF were entered in the last two steps. This sequence allowed for the testing of effects of knowledge on adaptability after controlling for skill, and the effects of affective variables after controlling for both skill and knowledge. The initial results indicated that only satisfaction contributed to the prediction of performance adaptability after controlling for previous task skill (final training performance). Satisfaction had a positive β weight, and it contributed significantly to the prediction of performance adaptability after controlling for ability, previous task performance, declarative knowledge, coherence, and SEFF ($\Delta R^2 = .011$, $\beta = .105$, $F = 6.71$, $p \leq .05$).

It is a powerful demonstration to show that an affective variable predicts performance adaptability after controlling for all of the other factors because this test is very stringent and conservative. It is clear that previous task performance is a function of the entire pattern of learning and regulatory processes that have taken place up to that point in time. Thus, partialling previous task performance essentially partials all of the processes and effects of learning and affect up to the final training trial. This makes the significance tests for the variables particularly conservative and limits the capability to identify the usefulness of learning and affective variables for understanding performance adaptability.

Two strategies were employed to address this problem. First, affective variables from the end of day one were used to predict final training performance on day two after controlling for ability. Learning and knowledge structure variables were not available at the end of day one, so they could not be included in this analysis. As can be seen in the bottom portion of Table 7, SEFF from day one predicted training performance on day

Table 7.

Effects of Individual Training Outcomes on Performance AdaptabilityDependent Variable: Performance Adaptability (Score 6)

Total Observations = 231

Number of teams = 77

 $df_{Total} = 231$ $df_{BtwnTeam} = 76$ $df_{WthnTeam} = 154$ $R^2_{Y.BtwnTeam} = .378$ $R^2_{Y.WthnTeam} = .622$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.050	.050		.080*	1
2	Ind Dec Know	.052	.002		.003	1
3	Coherence	.073	.021		.034*	1
4	Self-Efficacy	.111	.038		.061*	1
5	Satisfaction	.122	.011		.018*	1
Total		.122	.122	.000	.196*	5

Dependent Variable: End of Training Performance (Score 5)

Total Observations = 231

Number of teams = 77

 $df_{Total} = 231$ $df_{BtwnTeam} = 76$ $df_{WthnTeam} = 154$ $R^2_{Y.BtwnTeam} = .379$ $R^2_{Y.WthnTeam} = .621$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.068	.068		.109*	1
2	Satisfaction	.075	.007		.012	1
3	Self-Efficacy	.094	.019		.030*	1
Total		.094	.094	.000	.150*	3

Note: * indicates $p \leq .05$, two-tailed+ indicates $p \leq .05$, one-tailed

two, even after controlling for ability. This provides support for the idea that affective processes influence later training performance and adaptability. Furthermore, as argued earlier, by partialling task performance, the effects of affective variables and learning processes up until that point in time were partially or wholly removed.

The second strategy was to partial ability instead of performance on the final training trial. If performance adaptability is not due solely to ability, then it stands to reason that it is due to other factors like learning and self-regulatory processes. Significant effects of the training outcome variables on performance adaptability after controlling for ability provides strong support for the impact of individual training outcome variables on performance adaptability. Results of the regression analyses are presented at the top of Table 7. As can be seen in the table, all of the individual training outcomes except individual declarative knowledge were significantly related to performance adaptability, even after controlling for ability. The b weights for the variables were all in the positive direction, and outcomes of the significance tests were not influenced by order of entry. An additional 11.6 percent of the variance in performance adaptability within teams was explained by the individually-oriented training outcomes after controlling for ability.

An analysis of the effects of individual training outcomes on performance adaptability as measured by penalty circle intrusions was also performed. Penalty circle intrusions is a team level variable which was regressed on each of the training outcomes at the individual level. Thus, in the first step, penalty circle intrusions were simultaneously regressed on the cognitive ability scores of Alpha, Bravo, and Charlie, the second step added the individual declarative knowledge scores for all three members, and so forth.

This procedure investigated the impact of individual level training outcome variables on team level performance adaptability indicators.

The results are presented in the top portion of Table 8. Although the analysis had low power due to the intercorrelations among the training outcome variables and the limited sample size at the team level (total $df = 78$), multiple effects were found to be significant. For example, SEFF of the team members accounted for a significant proportion of variance in penalty intrusions on the adaptability task, even after controlling for cognitive ability, declarative knowledge, and coherence of knowledge. The training outcomes together predicted an additional 21 percent of the variance in penalty intrusions, even after controlling for ability. In fact, the training outcome variables together predicted an additional 8.3 percent of the variance in intrusions even after controlling for both ability and previous task performance. Also, in some cases, the b weights for specific positions were significant, even though the step for all three positions together was not significant. For example, the coherence of knowledge structure for the Charlie position was significantly related to fewer penalty circle intrusions, even after controlling for all 15 other variables in the model ($\beta = -.259$, $t = -2.18$, $p \leq .05$). The effect of Charlie's knowledge structure on penalty intrusions might have been due to the fact that the person in the Charlie position often engaged in monitoring activities for threatening contacts while the Alpha position rendered the final engage decision. Effective monitoring activities would require a deeper and more integrated understanding of the task. The bottom portion of Table 8 also demonstrates that affective variables at the end of day one predicted an additional 11.7 percent of the final training performance at the end of day two after

Table 8.**Effects of Individual Training Outcomes on Penalty Intrusions****Dependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)**

Step	Independent Variables	R² for Equation	R² Increment	F	df
1	Ability	.223	.223	6.90*	3,75
2	Ind Decl Knowl	.253	.030	.96	3,71
3	Coherence	.301	.048	1.57	3,68
4	Satisfaction	.343	.042	1.40	3,65
5	Self-Efficacy	.432	.089	3.29*	3,62
Total		.432	.432	6.47*	16,62

Dependent Variable: Penalty Intrusions on Final Training Task (PenInt5)

Step	Independent Variables	R² for Equation	R² Increment	F	df
1	Ability	.259	.259	8.72*	3,75
2	Satisfaction	.323	.064	2.26+	3,72
3	Self-Efficacy	.376	.053	1.96	3,69
Total		.376	.376	4.61*	9,69

Note: * indicates $p \leq .05$, two-tailed
 + indicates $p \leq .05$, one-tailed

controlling for ability, suggesting affective and learning variables were important determinants of later performance.

In sum, after evaluating the correlations and applying RMR analyses to investigate the unique effects of the individual training outcome variables on performance adaptability, strong support for Hypothesis 1a was obtained. With the exception of individual declarative knowledge, all of the different individual outcomes of training were found to be important for performance adaptability, and together they predicted a meaningful portion of variance. In particular, affective variables like satisfaction were related to performance adaptability even after controlling for all possible other outcomes of training.

Hypothesis 1b stated that team-oriented training outcomes would predict performance adaptability after controlling for individual training outcomes. This hypothesis was tested by repeating the previous analyses, but with the addition of team-oriented training outcomes at each step. Although the additional training outcomes were team-oriented, they still resided at the individual level. For example, PTEFF was the perception of a particular member that the team could be effective. Similarly, team declarative knowledge was the knowledge of a given person about team processes and positions.

As in the previous analyses, these tests are stringent and conservative. Training outcomes were generally highly correlated. For example, those individuals who knew a lot about their positions also tended to know a lot about other positions, performed well, and felt more efficacious than those who did not know a lot about their positions. The systematic partitioning of the variance by entering individually-oriented training outcomes

first meant that it was more difficult for the team-oriented training outcome variables to demonstrate an impact on performance. Thus, the entire pattern of regressions was replicated by entering team-oriented variables prior to individually-oriented variables to see if entering them first would alter conclusions. Also, one-tailed tests for a priori hypothesized effects were utilized to increase power. The results of the regression analyses are presented in Table 9.

It can be seen that similarity of knowledge structures predicted performance adaptability even after controlling for ability, individual declarative knowledge, team declarative knowledge, and coherence of knowledge structures. Furthermore, the effect of similarity of knowledge structures was significant even after partialling previous task performance along with the other variables in the equation. This indicates that sharedness of knowledge structures among team members is a crucial outcome of team training that is important beyond ability, basic task knowledge, coherence, or task experience. The finding is particularly striking because similarity was positively correlated with cognitive ability, individual and team declarative knowledge, and coherence, all of which were partialled prior to entering similarity.

The intercorrelations between SEFF and PTEFF were strong by the end of training ($r = .87$ and $.92$ at the individual and team levels, respectively). The high intercorrelations suggest that SEFF and PTEFF were both part of a general belief in competence for task performance. This is logical and to be expected on a highly interdependent task. Entering both SEFF and PTEFF as a block yielded a significant increment in R^2 . However, neither SEFF nor PTEFF predicted a significant amount of variance in performance adaptability

Table 9.

Effects of All Training Outcomes on Performance AdaptabilityDependent Variable: Performance Adaptability (Score 6)

Total Observations = 231

Number of teams = 77

 $df_{\text{Total}} = 231$ $df_{\text{BtwnTeam}} = 76$ $df_{\text{WthnTeam}} = 154$ $R^2_{Y.BtwnTeam} = .378$ $R^2_{Y.WthnTeam} = .622$

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.050	.050		.080*	1
2	Ind Dec Knw	.052	.002		.003	1
3	Tm Dec Knw	.052	.001		.001	1
4	Coherence	.073	.021		.033*	1
5	Similarity	.082	.009		.015+	1
6	Self-Efficacy	.118	.036		.057*	1
7	Pers Team-Eff	.121	.004		.006	1
8	Satisfaction	.128	.007		.011	1
9	Cohesion	.137	.009		.015	2
Total		.137	.137	.000	.221*	10

Reversing Individual and Team Variables

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.050	.050		.080*	1
2	Tm Dec Knw	.051	.002		.003	1
3	Ind Dec Knw	.052	.001		.002	1
4	Similarity	.064	.011		.019*	1
5	Coherence	.082	.018		.029*	1
6	Pers Team-Eff	.119	.037		.059*	1
7	Self-Efficacy	.121	.002		.004	1
8	Cohesion	.133	.012		.020+	2
9	Satisfaction	.137	.004		.007	1
Total		.137	.137	.000	.223*	10

Table 9 (Cont'd).

Dependent Variable: End of Training Performance (Score 5)

Total Observations = 231

Number of teams = 77

 $df_{\text{Total}} = 231$ $df_{\text{BtwnTeam}} = 76$ $df_{\text{WithinTeam}} = 154$ $R^2_{Y.\text{BtwnTeam}} = .379$ $R^2_{Y.\text{WithinTeam}} = .621$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.068	.068		.109*	1
2	Satisfaction	.075	.007		.012	1
3	Cohesion	.082	.007		.012	2
4	Self-Efficacy	.103	.021		.034*	1
5	Pers Team-Eff	.105	.002		.004	1
Total		.105	.105	.000	.171*	6

Reversing Individual and Team Variables

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.068	.068		.109*	1
2	Cohesion	.075	.007		.012	2
3	Satisfaction	.082	.007		.012	1
4	Pers Team-Eff	.098	.016		.026*	1
5	Self-Efficacy	.105	.007		.011	1
Total		.105	.105	.000	.171*	6

Note: * indicates $p \leq .05$, two-tailed+ indicates $p \leq .05$, one-tailed

after controlling for the other. A similar pattern was obtained for the prediction of day two training performance from efficacy perceptions at the end of day one.

In sum, it appears that perceptions of efficacy, both self and team, are important training outcome variables that influence performance adaptability, even after controlling for other training outcome variables. However, these beliefs in competence appeared to merge over time. Additionally, shared knowledge structures among team members is a crucial aspect of learning in a training environment. In spite of the conservative nature of the significance tests, shared knowledge structures and perceptions of efficacy were found to be related to performance adaptability.

The analyses were replicated using penalty intrusions as an indicator of performance adaptability. Ability was entered first, followed by declarative knowledge, structural knowledge, efficacy, satisfaction, and cohesion. The results are presented in Table 10. It can be seen that team declarative knowledge and social cohesion predicted performance adaptability after controlling for a variety of individually-oriented training outcomes. Also, task cohesion at the end of day one predicted training penalty intrusions on day two.

All of the team-oriented effects on penalty intrusions were obtained in spite of the low power and after controlling for ability, which is a conservative test of the expected effects. Also, entering the variables in blocks with all position level variables entered at once often masked important relationships. For example, as before, the effect of coherence of Charlie's knowledge structure on intrusions during the adaptability task was significant at the point of entry and in the last equation even after controlling for all other variables included in the model ($\beta = -.234$, $t = -1.98$, $p \leq .05$). Additionally, the similarity of

Table 10.

Effects of All Training Outcomes on Penalty IntrusionsDependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.218	.218	6.90*	3,74
2	Ind Dec Knowl	.251	.033	1.05	3,71
3	Tm Dec Knowl	.318	.066	2.19+	3,68
4	Coherence	.362	.045	1.52	3,65
5	Similarity	.395	.033	1.11	3,62
6	Self-Efficacy	.476	.081	3.06*	3,59
7	Pers Team-Efficacy	.485	.009	0.81	3,56
8	Satisfaction	.515	.029	1.06	3,53
9	Social Cohesion	.600	.085	3.56*	3,50
10	Task Cohesion	.620	.020	0.82	3,47
		.620	.620	2.55	30,47

Reversing Individual and Team Variables

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.218	.218	6.90*	3,74
2	Tm Dec Knowl	.294	.075	2.52+	3,71
3	Ind Dec Knowl	.318	.024	0.80	3,68
4	Similarity	.368	.050	1.76	3,65
5	Coherence	.395	.027	0.92	3,62
6	Pers Team-Efficacy	.468	.073	2.70*	3,59
7	Self-Efficacy	.485	.017	0.63	3,56
8	Social Cohesion	.577	.092	3.85*	3,53
9	Task Cohesion	.591	.014	0.55	3,50
10	Satisfaction	.620	.029	1.18	3,47
		.620	.620	2.55	30,47

Table 10 (Cont'd).

Dependent Variable: Penalty Intrusions on Final Training Task (PenInt5)

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.259	.259	8.72*	3,75
2	Satisfaction	.323	.064	2.26+	3,72
3	Social Cohesion	.334	.011	0.38	3,69
4	Task Cohesion	.395	.062	2.24+	3,66
5	Self-Efficacy	.448	.053	2.00	3,63
6	Pers Team-Efficacy	.462	.014	0.52	3,60
Total		.462	.462	2.86*	18,60

Reversing Individual and Team Variables

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.259	.259	8.72*	3,75
2	Social Cohesion	.299	.040	0.26	3,72
3	Task Cohesion	.337	.038	1.31	3,69
4	Satisfaction	.395	.059	2.20+	3,66
5	Pers Team-Efficacy	.409	.014	0.50	3,63
6	Self-Efficacy	.462	.052	1.96	3,63
Total		.462	.462	2.86*	18,60

Note: * indicates $p \leq .05$, two-tailed

+ indicates $p \leq .05$, one-tailed

Charlie's knowledge structure to Alpha's knowledge structure was significant after controlling for all variables ($\beta = -.305$, $t = -2.389$, $p \leq .05$). Both of these effects were in theoretically expected directions and they are consistent with the notion that Alpha and Charlie coordinated activities of decision making and monitoring. Also, these effects suggest that it may be more important for certain members to share certain types of knowledge than for all team members to share the same knowledge.

In sum, it appears that team-oriented training outcomes are important for understanding performance adaptability, even after controlling for numerous alternative explanations of obtained findings. This provides strong support for Hypothesis H1b. It is not enough that individually-oriented skills, knowledge, and affect are developed. Team-oriented variables like shared knowledge structures, team declarative knowledge, and cohesion are all related to different forms of performance adaptability. Additionally, SEFF and PTEFF began to merge into a single generalized feeling of task competence for an individual member and the team as a unit. This was not hypothesized a priori, but it makes sense given the high levels of task interdependence; each member's performance was dependent on the performance of the entire team.

Effects of Goals

Performance adaptability. Hypothesis 2 stated that self-set goals during training would influence performance adaptability. A correlational analysis was performed in which INDGLS and team goals (TMGLS) set just prior to the last training trial were correlated with performance adaptability at the individual and team levels. The correlations between the INDGLS on the final training trial and performance adaptability scores were .18 and .31 at the individual and team levels, respectively. The correlations between INDGLS and

penalty intrusions were -.11 and -.15, at the individual and team levels. TMGLS were correlated .19 and .43 with performance adaptability scores at the individual and team levels. The correlations between TMGLS and penalty intrusions were -.21 and -.30 at the individual and team levels. All correlations were significant except for the relationship between individual goal and penalty intrusions computed at the team level. Also, the relationships between TMGLS and performance adaptability were consistently larger in magnitude.

A follow-up MVMR analysis was performed, simultaneously regressing the dependent variables of penalty intrusions and scores by position onto individual and team goals across all training trials for the members within each team (24 predictors, goals for 3 positions X 4 trials X 2 levels). This analysis was significant for all multivariate tests, including Pillais' trace, $F(96, 164) = 1.59, p \leq .05$. It indicated that some combination of INDGLS or TMGLS was significantly related to performance adaptability, as indicated by score and penalty intrusions. These results provide strong support for Hypotheses 2 and 2a, which stated that self-set TMGLS should influence performance adaptability.

Hypothesis 2a suggested that teams with members who self-set higher TMGLS would exhibit greater performance adaptability than teams comprised of members who self-set lower TMGLS. This hypothesis was supported with the obtained correlations, but it was further tested using the analyses designed to test both Hypotheses 2a and 2b. First, a RMR analysis was performed. Second, a regression analysis was performed, simultaneously regressing penalty intrusions on the adaptability task onto the goals for each of the three team members. Third, a three level HLM analysis was performed to

investigate the relationship between goals and performance across trials, within each position, within each team.

The results of the RMR analyses are presented in Table 11. Ability was entered first, followed by TMGLS at the end of training, followed by INDGLS, then the individual goal by team goal interaction. The RMR analysis was repeated by switching the order of entry for INDGLS and TMGLS. A multiple regression was also performed on the penalty intrusions. This analysis is also presented in Table 11. Ability of the three members was entered, followed by either INDGLS or TMGLS for the three members, followed by the interaction terms. It can be seen that either INDGLS or TMGLS significantly predicted score performance on the adaptability task, but neither contributed significantly beyond the other. TMGLS predicted penalty intrusions, even after controlling for ability and INDGLS. Goals together predicted an additional 8.4 percent of the variance in performance adaptability score and an additional 14.1 percent of the variance in penalty intrusions, both after controlling for ability.

One alternative explanation for the effect of goals on the last training trial is that they were surrogates for previous task performance. To some degree, this argument is addressed by partialling ability first. However, a three level HLM model was employed to provide more robust evidence against this argument. In the three level model, performance by trial was at the lowest level, cognitive ability was at the person level, and team characteristics like feedback type were at the team level. Thus, performance was modeled at the trial level, using goals immediately preceding that trial as the predictor, with ability included in the equation at the person level. Because the goals were modeled at the trial

Table 11.

Effects of Individual and Team Goals on Performance AdaptabilityDependent Variable: Performance Adaptability (Score 6)

Total Observations = 231

Number of teams = 77

 $df_{\text{Total}} = 231$ $df_{\text{BtwnTeam}} = 76$ $df_{\text{WhtnTeam}} = 154$ $R^2_{Y.\text{BtwnTeam}} = .378$ $R^2_{Y.\text{WhtnTeam}} = .622$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.051	.051		.082*	1
2	Team Goals	.088	.037		.060*	1
3	Indiv Goals	.096	.009		.014	1
4	IGls x TGls	.103	.007		.011	1
Total		.103	.103	.000	.167*	4

Reverse Order of Entry for Individual and Team Goals

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.051	.051		.082*	1
2	Indiv Goals	.091	.040		.064*	1
3	Team Goals	.096	.005		.009	1
4	IGls x TGls	.103	.007		.011	1
Total		.103	.103	.000	.167*	4

Dependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)

Step	Independent Variables	R^2 for Equation	R^2 Increment	F	df
1	Ability	.204	.204	5.99*	3,70
2	Team Goals	.292	.087	2.75*	3,67
3	Individual Goals	.317	.025	0.78	3,64
4	Ind Gls x Tm Gls	.345	.028	0.88	3,61
Total		.345	.345	2.68*	12,61

Table 11 (Cont'd).

Reverse Order of Entry for Individual and Team GoalsDependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.204	.204	5.99*	3,70
2	Individual Goals	.247	.042	2.26	3,67
3	Team Goals	.317	.070	2.18+	3,64
4	Ind Gls x Tm Gls	.345	.028	0.88	3,61
Total		.345	.345	2.68*	12,61

Note: * indicates $p \leq .05$, two-tailed
+ indicates $p \leq .05$, one-tailed

level and ability was controlled, it is more difficult to argue that goals are only a surrogate for previous performance.

The initial variance partitioning findings of the HLM analyses are presented in Table 12. It can be seen from this table that most of the variance in performance was within person over time (60.2 %), suggesting strong learning and regulatory effects. By definition, this variance had to come from processes unfolding within a person over time. There were also significant amounts of between person (31.2 %, $\chi^2 = 610.95$, $p \leq .05$) and between team variability (8.7 %, $\chi^2 = 137.52$, $p \leq .05$) in performance, indicating person and team level factors impacted performance over time.

When only TMGLS were entered into the model, they significantly predicted performance on each trial, even after controlling for ability. However, when both INDGLS and TMGLS were entered simultaneously into the same model, neither goal effect was significant. INDGLS and TMGLS were highly correlated with each other, and neither predicted performance after controlling for the other. This indicated that both types of goals were part of a general goal construct which significantly predicted performance over trials. Thus, there was strong support for the influences of goals on performance adaptability, but not specifically for TMGLS. On a highly interdependent team, it appears that goals to perform well on the task are intertwined for individual positions as well as for the team as a unit. Hypothesis 2b was tested by the RMR and HLM analyses. No support was obtained for the interaction effect of INDGLS and TMGLS on performance adaptability. This may have been due to the high intercorrelation between INDGLS and TMGLS, limiting the ability to detect an interaction effect.

Table 12.

Three Level HLM Model of Goals and Performance by Trial**Intercepts Only**

$$\begin{aligned}\text{Level 1:} \quad & Y_{ijk} = \pi_{0jk} + e_{ijk} \\ \text{Level 2:} \quad & \pi_{0jk} = \beta_{00k} + r_{0jk} \\ \text{Level 3:} \quad & \beta_{00k} = \gamma_{000} + u_{00k}\end{aligned}$$

<u>Variance Components</u>	<u>Percent of Total</u>	<u>Reliability</u>
σ^2 (score within person):	60.2	
Tau(π) (mean score within teams):	31.2	.674
Tau(β) (mean team differences):	8.7	1.000
Total variance:	100.0	

<u>Fixed Effects</u>	<u>Coefficient</u>	<u>Standard error</u>	<u>t ratio</u>	<u>p value</u>
Avg team mean, γ_{000}	897.06	36.48	24.59	0.000

<u>Random Effects</u>	<u>Variance Component</u>	<u>df</u>	<u>χ^2</u>	<u>p value</u>
Trials (level 1)	292866.00			
Individual members (level 2)	151655.40	176	610.95	0.000*
Teams (level 3)	42179.46	87	137.52	0.001*

Final Model

$$\begin{aligned}\text{Level 1:} \quad & Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{TEAM GOAL}) + e_{ijk} \\ \text{Level 2:} \quad & \pi_{0jk} = \beta_{00k} + \beta_{01k}(\text{COGNITIVE ABILITY}) + r_{0jk} \\ & \pi_{1jk} = \beta_{10k} + r_{1jk} \\ \text{Level 3:} \quad & \beta_{00k} = \gamma_{000} + u_{00k} \\ & \beta_{01k} = \gamma_{010} \\ & \beta_{10k} = \gamma_{100} + u_{10k}\end{aligned}$$

<u>Variance Components</u>	<u>Variance Estimate</u>	<u>Reliability</u>
σ^2 (residual):	282852.43	
Tau(π_0) (person effect on performance):	134880.47	.350
Tau(π_1) (person effect on goal slope):	695.33	.012
Tau(β_{00}) (team effect on performance):	34498.28	1.000
Tau(β_{10}) (team effect on goal slope):	4360.41	1.000

<u>Fixed Effects</u>	<u>Coefficient</u>	<u>Std error</u>	<u>t ratio</u>	<u>p value</u>
Average performance, γ_{000}	370.76	129.54	2.862	0.005*
<u>Person Effects on Performance</u>				
Cognitive Ability β_{01k} , γ_{010}	21.16	5.12	4.134	0.000*
Average team goal slope, γ_{100}	26.86	13.40	2.004	0.047*

Table 12 (Cont'd).

Random Effects	Variance Component	df	χ^2	p value
Level 1 and Level 2				
Residual Variance (level 1), e_{ijk}	282852.43			
Person Differences in Performance, r_{0jk}	134880.47	174	518.52	0.000*
Person Differences in Goal Slope, r_{1jk}	695.33	175	318.91	0.000*
Level 3				
Team Differences in Performance, u_{00k}	34498.28	87	146.66	0.000*
Team Differences in Team Goal Slope, u_{10k}	4360.41	87	132.92	0.001*

Note: * indicates $p \leq .05$, two-tailed
+ indicates $p \leq .05$, one-tailed

Training outcomes. According to Hypotheses 3 and 3a, self-set goals were expected to be related to individually-oriented training outcomes like individual declarative knowledge, coherence of knowledge structures, and performance during training. The first test of these hypotheses were performed using correlational analyses. A significant relationship between INDGLS after the first trial and individual declarative knowledge at the end of training was obtained at the individual and team levels ($r = .12$ and $r = .22$, $p \leq .05$). However, INDGLS on the last training trial were not related to individual declarative knowledge ($r = .08$ and $r = .08$, $p > .15$). Neither INDGLS nor TMGLS for any trial were related to coherence of knowledge structures. INDGLS and TMGLS on the fourth and fifth training trials were significantly related to individual performance on the last training trial. As found in the HLM analysis, earlier INDGLS and TMGLS were related to later training trial performance. Table 13 presents correlations between INDGLS and TMGLS on the last training trial and a variety of individually-oriented training outcomes.

A MVMR model was tested by regressing the individual declarative knowledge, performance adaptability scores, and coherence onto INDGLS and TMGLS. The multivariate significance tests provided partial support for the effect of goals on individual training outcomes. Pillais' trace was not significant, $F(216, 351) = 1.10$, $p > .05$, but Hotelling's trace, $F(216, 263) = 1.27$, $p \leq .05$ was significant. Wilks' lambda, $F(216, 282.11) = 1.18$, $p \leq .10$, was marginal. Pillais' trace is a more conservative test than the other tests, but it is also more robust against violations of assumptions. An investigation of the specific outcomes potentially being influenced suggested that final training performance was strongly influenced by goals and individual declarative knowledge was weakly influenced by goals.

Table 13.

Relationship Between Goals and Individually-Oriented Training Outcomes

	Individual Level		Team Level	
	<u>Ind Goal</u>	<u>Team Goal</u>	<u>Ind Goal</u>	<u>Team Goal</u>
Ind Dec Knowledge	.08	.01	.08	.14
Coherence of Know Struct	-.09	-.04	.07	.13
Individual skill	.17*	.20*	.26*	.46*
Self-Efficacy	.35*	.34	.30*	.43*
Satisfaction	.14*	.12*	.28*	.25*

Multivariate Tests of Significance for Declarative Knowledge, Coherence, and Skill

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	3.625	1.10	216.00	351.00	.223
Hotellings	9.390	1.27	216.00	263.00	.032*
Wilks	0.00431	1.18	216.00	282.11	.095+
Roys	.764				

Note: * indicates $p \leq .05$, two-tailed

+ indicates $p \leq .05$, one-tailed

A series of RMR analyses were performed, partialling ability first, then entering INDGLS, TMGLS, and their interaction into the equation. After controlling for ability, TMGLS on the last trial were found to predict training performance on the last trial ($\Delta R^2 = .028$, $\beta = .268$, $F = 4.84$, $p \leq .05$). INDGLS on the last trial were also found to predict individual declarative knowledge ($\Delta R^2 = .015$, $\beta = .278$, $F = 4.01$, $p \leq .05$). In sum, it appears that INDGLS were related to individual declarative knowledge, and as illustrated in the HLM model, goals in general predicted skill during training. These effects were obtained even after controlling for ability. The entire pattern of results provides partial support for Hypotheses 3 and 3a. No support was obtained for Hypothesis 3b, probably because INDGLS and TMGLS were difficult to distinguish on an interdependent task.

Hypothesis 3c suggested that meeting or exceeding INDGLS would lead to more positive individually-oriented affect and attitudes. Hypothesis 3d stated that the interaction of meeting or exceeding both INDGLS and TMGLS would significantly predict individually-oriented affect and attitudes. These hypotheses were analyzed using two different approaches. The first technique was to dummy code people as either having exceeded their goals on the final training task or not and then performing an RMR analysis on members within teams. The previous level of affect or attitude was entered first, followed by the variable indicating whether INDGLS were exceeded. Then the variable indicating whether TMGLS were exceeded was entered, followed by their interaction. This is a direct test of Hypotheses 3c and 3d, but it involves the dichotomization of the continuous construct of goal attainment. A significant result was obtained for SEFF. After controlling for previous SEFF, meeting or exceeding INDGLS on the second training trial

significantly predicted SEFF on the fourth and final training trial ($\Delta R^2 = .01$, $\beta = .089$, $F = 4.597$, $p \leq .05$).

As an alternative check on the findings, a second strategy was employed to test the hypotheses of interest. The idea that meeting or exceeding goals will influence affect/attitudes implies that performance should influence these variables after controlling for previous goals. In other words, if previous goals are partialled first, then an effect of performance on affective or attitudinal variables provides support for Hypothesis 3c. A RMR analysis was performed in which the previous level of the variable of interest was partialled, followed by INDGLS and TMGLS, followed by the goal interaction, followed by individual and team scores, followed by the individual by team score interactions. The effect of individual score on SEFF at the end of training after controlling for previous SEFF and goals was significant ($\Delta R^2 = .011$, $\beta = .109$, $F = 3.667$, $p \leq .05$, one-tailed), providing additional support for the earlier analyses.

The analyses for the effects of meeting or exceeding INDGLS and TMGLS provide some support for Hypothesis 3c, but no support for Hypothesis 3d. Meeting or exceeding goals had an influence on SEFF, but the interaction between meeting INDGLS and TMGLS was not significant. Additionally, meeting or exceeding goals did not appear to influence satisfaction. However, both INDGLS and TMGLS were strongly related to affect and attitudinal outcomes as main effects.

Hypothesis 4 stated that self-set goals would influence team-oriented training outcomes like team declarative knowledge, similarity of knowledge structures, and team-oriented affect and attitudes. Hypotheses 4a and 4b indicated that TMGLS and the

individual by team goal interactions should influence team declarative knowledge. These hypotheses were tested using correlational, MVMR and RMR analyses.

First, correlations between INDGLS and TMGLS and team declarative knowledge were computed at the individual and team levels. No support was obtained for the effect of TMGLS on team declarative knowledge. At the individual level, INDGLS were significantly related to team declarative knowledge on the first and last training trials ($r = .134$ and $r = .136$, $p \leq .05$). None of the correlations between TMGLS and team declarative knowledge were significant.

A MVMR model was tested by regressing the scores for team declarative knowledge by position onto INDGLS and TMGLS by position and trial. The multivariate significance tests provided no overall support for the effect of goals on team declarative knowledge. None of the multivariate tests were significant, including Pillais' trace, $F(36, 171) = 0.951$, $p > .10$.

A series of RMR analyses were performed to test for the potential interactive effects of INDGLS and TMGLS on team declarative knowledge. Ability was partialled first, followed by INDGLS, TMGLS, and their interaction. A significant effect of INDGLS on team declarative knowledge was obtained. The effect of INDGLS remained significant even after including TMGLS in the equation ($\Delta R^2 = .032$, $\beta = .250$, $F = 8.64$, $p \leq .05$), but neither the effect of TMGLS nor the interaction term was significant. Thus, although there was a significant effect of INDGLS on team declarative knowledge, there was no support for Hypotheses 4a and 4b.

Hypothesis 4c suggested that teams comprised of members who self-set high TMGLS would exhibit greater sharedness of knowledge structures and greater team skill

by the end of training. This was tested using correlational analyses. Correlations between team and INDGLS and sharedness and team skill MVMR, and MR were computed at individual and team levels. At the individual level, INDGLS and TMGLS by trial were correlated with individual sharedness, as operationalized by the similarity index of a given member's ratings with the team's average ratings for each of the pairs between concepts. The goals by trial were also correlated with individual scores on the final training trial. Individual scores are strongly related to team scores, so they are a useful index of team skill by the end of training. Both INDGLS and TMGLS were correlated with training outcomes across trials. The particular correlations of interest for Hypothesis 4c were the correlations between INDGLS and TMGLS on the final training trial and similarity and team score. These correlations are presented in Table 14. It can be seen that both INDGLS and TMGLS were correlated with sharedness and team skill.

The MVMR analysis for the simultaneous prediction of team score and similarity from all INDGLS and TMGLS across trials was marginally significant using Hotelling's trace, $F(48, 74) = 1.81, p \leq .10$ and Wilks' lambda, $F(48, 76) = 1.38, p \leq .10$. This provided limited support for the effect of goals across trials on similarity and score.

Hypothesis 4d suggested an interactive effect of INDGLS and TMGLS on sharedness and team skill. This was tested using MR. A series of multiple regression analyses were performed to determine the pattern and nature of effects. The first set of regressions investigated the effect of goals on similarity. First, ability by position was entered, followed by the entry of TMGLS for each position. This was followed by INDGLS and then the interaction terms by position. The goals were those set prior to the final training trial. Although effects were in the hypothesized directions, the only

Table 14.**Relationship Between Goals and Team-Oriented Training Outcomes**

	Individual Level		Team Level	
	<u>Ind Goal</u>	<u>Team Goal</u>	<u>Ind Goal</u>	<u>Team Goal</u>
Team Dec Knowledge	.14*	.07	.08	.06
Similarity of Know Struct	.14*	.20*	.23*	.27*
Team Skill	.17*	.20*	.26*	.46*
Personal Team-Efficacy	.29*	.38*	.29*	.53*
Social Cohesion	.01	.12	.06	.26*
Task Cohesion	.14*	.18*	.18	.26*

Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	1.63	1.12	96.00	156.00	.260
Hotellings	3.05	1.10	96.00	138.00	.307
Wilks	0.11284	1.11	96.00	145.13	.282
Roys	0.578				

Note: * indicates $p \leq .05$, two-tailed
+ indicates $p \leq .05$, one-tailed

significant effect obtained for similarity was the effect of TMGLS for the Alpha position ($\beta = .255$, $t = 2.271$, $p \leq .05$). All regressions were repeated using final training score as the dependent variable. After controlling for ability, TMGLS predicted a significant amount of variance in final team training performance, $\Delta R^2 = .182$, $F = 6.43$ (3, 67), $p \leq .05$. No other effects were significant.

Taken together, the results provide partial support for the effects of self-set TMGLS on sharedness of knowledge structures and team skill. Correlations between TMGLS and similarity measures were all significant. TMGLS appeared to have a small to moderate effect on the sharedness of knowledge structures after controlling for ability. TMGLS had a strong effect on team skill as measured by team scores on the final training task. The effect of TMGLS on team skill was significant even after controlling for ability. Neither INDGLS nor TMGLS contributed predictive usefulness after controlling for the other set of goals. This provides further support for the notion that INDGLS and TMGLS become homologous on highly interdependent teams. There was no evidence that INDGLS and TMGLS had an interactive effect on skill or sharedness of knowledge structures. In sum, there was support for Hypothesis 4c and no support for Hypothesis 4d.

Hypothesis 4e suggested meeting or exceeding TMGLS would lead to more positive team-oriented affect and attitudes. Hypothesis 4f stated that the interaction of meeting or exceeding both INDGLS and TMGLS would significantly predict team-oriented affect and attitudes. These hypotheses were analyzed using the same two approaches employed for testing the effect of meeting or exceeding INDGLS and TMGLS on individually-oriented affect and attitudes. The first technique was to dummy code people as either having exceeded their goals on the final training task or not and then

performing a RMR analysis on members within teams. The previous level of affect or attitude was entered first, followed by the variable indicating whether TMGLS were exceeded. Then the variable indicating whether INDGLS were exceeded was entered, followed by their interaction. This is a direct test of Hypotheses 4e and 4f, but it involves the dichotomization of the continuous construct of goal attainment. PTEFF, social cohesion, and task cohesion were the dependent variables of interest.

As mentioned, previous levels of affect or attitude were partialled prior to entering the effect of meeting or exceeding goals, making this a conservative test. A significant result was obtained for the effect of exceeding TMGLS at the end of day one on PTEFF at the end of day one ($\Delta R^2 = .01$, $F = 3.92$, $p \leq .05$). Using a one-tailed test, a significant result was obtained for the main effect of exceeding TMGLS on the second trial on the PTEFF of the third trial ($\Delta R^2 = .01$, $F = 3.06$, $p \leq .05$, one-tailed). Exceeding TMGLS also interacted with exceeding INDGLS to affect PTEFF on the third trial ($\Delta R^2 = .01$, $F = 3.22$, $p \leq .05$, one-tailed). This interaction is graphed in Figure 24. It can be seen that meeting or exceeding TMGLS, INDGLS, or both resulted in higher levels of PTEFF. However, when neither TMGLS nor INDGLS were exceeded, low levels of PTEFF resulted. Exceeding TMGLS on the third training trial influenced PTEFF on the final training trail ($\Delta R^2 = .01$, $F = 12.25$, $p \leq .05$, one-tailed).

Meeting or exceeding TMGLS provided no incremental contribution to prediction when meeting or exceeding INDGLS was entered first. The only exception was the interaction obtained for the effects of meeting or exceeding both types of goals on PTEFF on the third trial. Overall, the pattern of the results provide support for the effects of

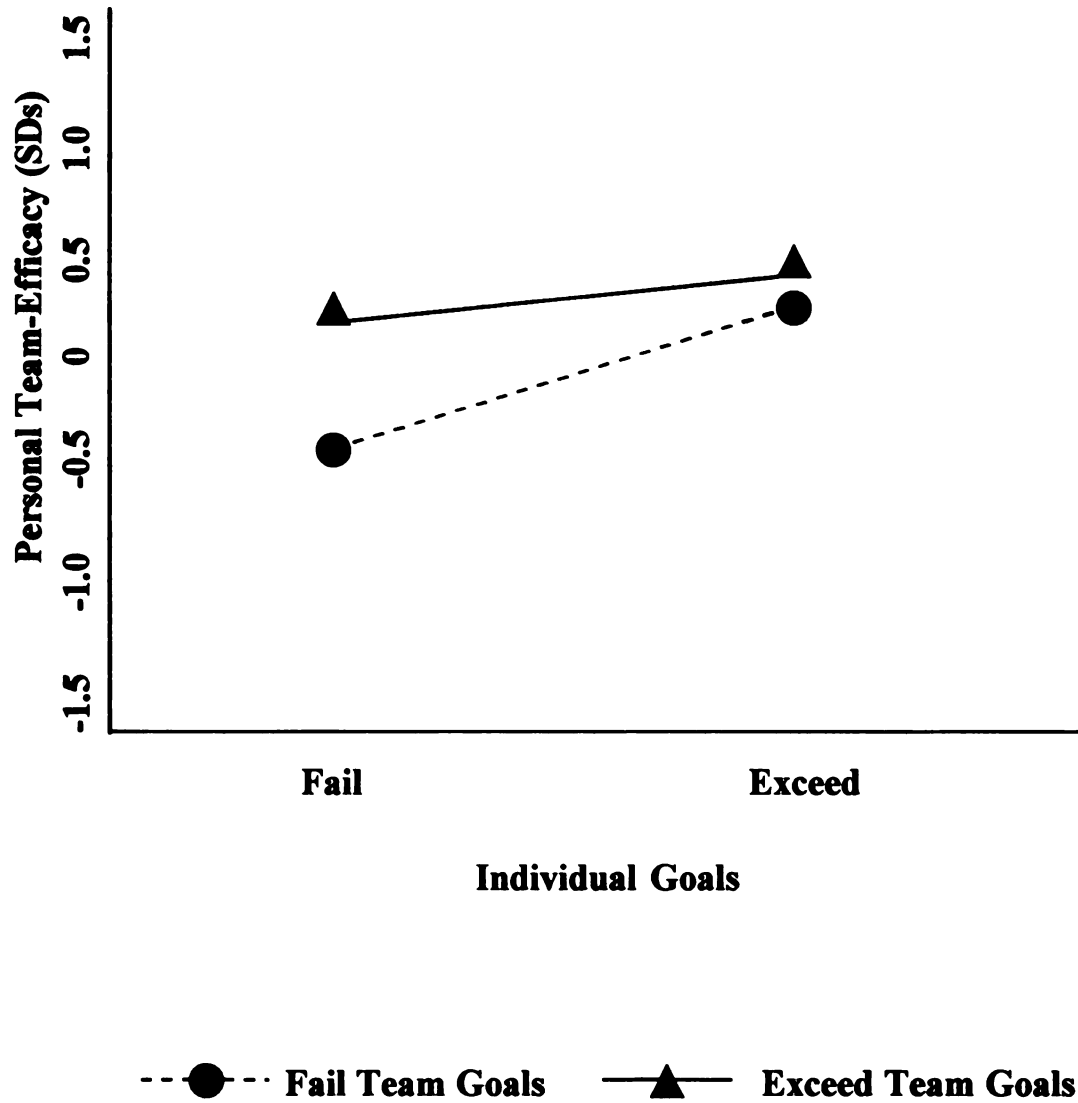


Figure 24. Interaction Effect of Exceeding or Failing to Meet Individual and Team Goals on Personal Team-Efficacy

meeting or exceeding TMGLS on PTEFF, affirming Hypothesis 4e. However, it is not clear that the effects of meeting or exceeding INDGLS or TMGLS are distinguishable. Some support for the interaction effect was obtained on the third training trial, providing limited support for Hypothesis 4f. No significant effects of meeting or exceeding INDGLS or TMGLS as dichotomous predictors were obtained for social and task cohesion.

The second method of analyzing the data involved partialling goal effects prior to evaluating score effects. First, prior levels of affect were partialled, followed by INDGLS and TMGLS, then team score, then individual score, then the individual by team score interaction. If team score or the individual by team score interaction is significant, then it provides support for Hypotheses 4e and 4f, respectively.

Significant effects were obtained for PTEFF that replicated the previous set of analyses. In other words, team score contributed to the prediction of efficacy after controlling for goals, and findings were in the same pattern as those obtained above. Significant effects were also obtained for social and task cohesion. Specifically, team score on the final training trial significantly incrementally predicted social cohesion after controlling for previous social cohesion, INDGLS, TMGLS, and the goal interaction ($\Delta R^2 = .01$, $F = 3.68$, $p \leq .05$). This provides further support for Hypothesis 4e for the dependent variable of social cohesion. Additionally, a significant interaction effect was obtained for the incremental effect of individual and team scores on task cohesion at the end of training ($\Delta R^2 = .02$, $F = 5.87$, $p \leq .05$). This interaction effect is plotted in Figure 25. An unexpected pattern emerged from the data when the interaction was plotted. It was expected that meeting or exceeding INDGLS or TMGLS would lead to higher levels of task cohesion, with the highest levels obtained when both forms of goals were exceeded.

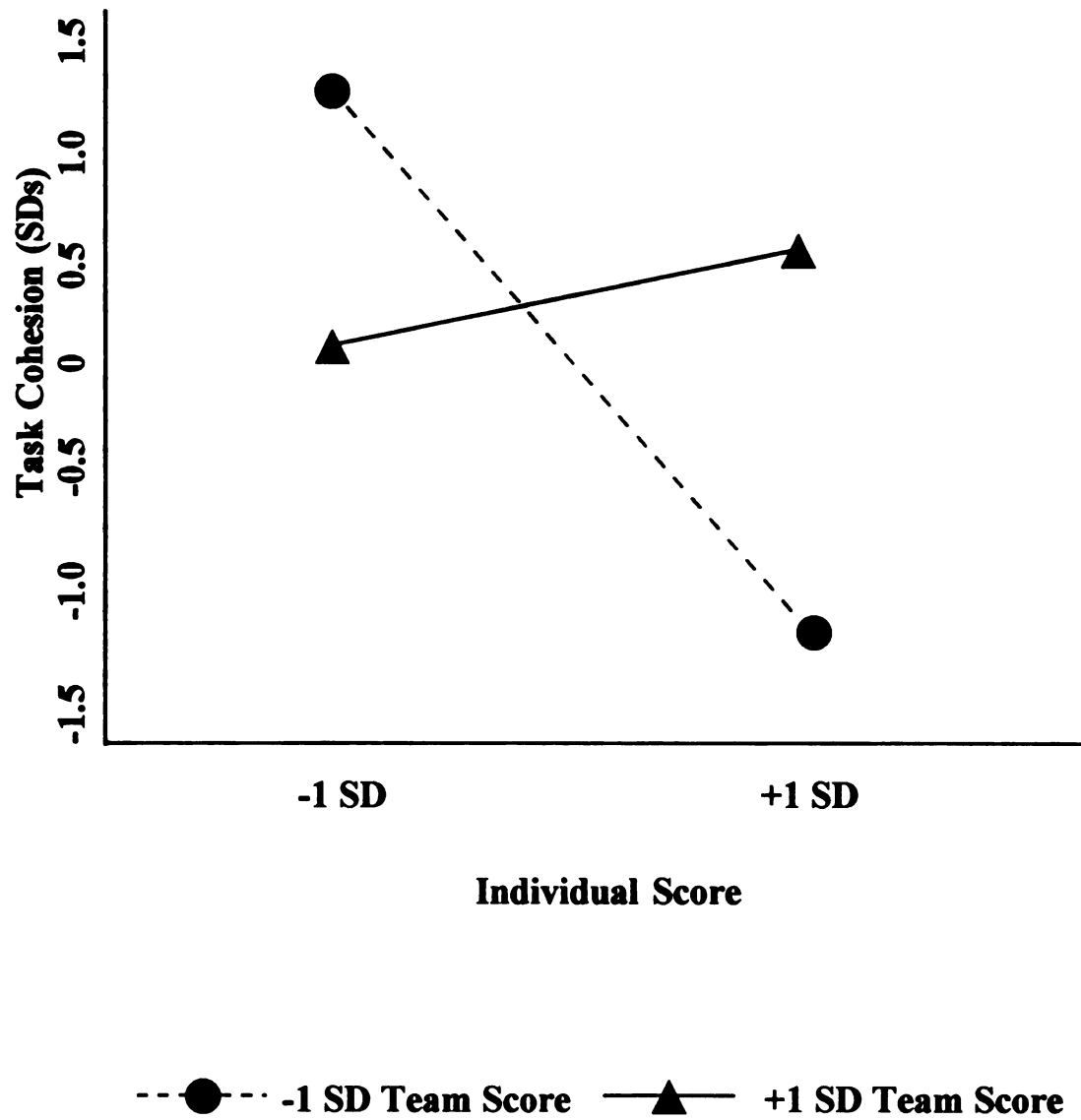


Figure 25. Interaction Effect of Exceeding or Failing to Meet Individual and Team Goals on Task Cohesion

However, it was found that after partialling for goals, the highest levels of task cohesion were obtained when both individual scores and team scores were low. This might be explained by the cohesion as a reaction to threat hypothesis. In other words, when members failed to meet their goals, they bonded together more tightly on the task in order to overcome the failure. Additionally, when individuals did well, but the team did not do well, levels of task cohesion were the lowest of all.

Overall, consistent support for the effects of goals on a variety of training outcomes was obtained. Evidence for the effect of goals on individual and team declarative knowledge was obtained. There was also strong evidence that goals influenced individual and team skills. Partial evidence for the effects of goals on sharedness of knowledge structures was obtained. Finally, evidence supporting the idea that meeting or exceeding INDGLS or TMGLS would lead to more positive affect and attitudes was obtained for SEFF, personal-team efficacy, and social cohesion. There was no evidence for interaction effects of INDGLS and TMGLS on skills or different forms of cognitive outcomes of training. The interaction effect of INDGLS and TMGLS was obtained only for attitudes and affective outcomes. These effects occurred for PTEFF and task cohesion.

Effects of Efficacy

Performance adaptability. Hypothesis 5 suggested that perceptions of efficacy during training would influence performance adaptability. A correlational analysis was performed in which SEFF and PTEFF just after the last training trial were correlated with performance adaptability at the individual and team levels. The correlations between the SEFF after the final training trial and performance adaptability scores were .17 and .24 at the individual and team levels, respectively. The correlations between SEFF and penalty

intrusions were $-.12$ and $-.19$, at the individual and team levels. PTEFF measures were correlated $.18$ and $.28$ with performance adaptability scores at the individual and team levels. The correlations between PTEFF and penalty intrusions were $-.21$ and $-.29$ at the individual and team levels. All correlations were significant except for the relationships between SEFF and penalty intrusions at both levels. Also, the relationships between PTEFF and performance adaptability were consistently larger in magnitude than the same relationships for SEFF.

A follow-up MVMR analysis was performed, simultaneously regressing the dependent variables of penalty intrusions and scores by position onto SEFF and PTEFF at the end of day one and day two for the members within each team (12 predictors, efficacy for 3 positions X 2 days X 2 self and team). This analysis was not significant for the multivariate tests, including Pillais' trace, $F(48, 268) = 1.19, p > .10$. The nonsignificant finding was likely due to the redundancy in information provided by including both SEFF and PTEFF as predictors. It might be recalled that both perceptions of efficacy were highly correlated by the final training trial. This intercorrelation substantially reduces the power of the multivariate significance test.

A follow up analysis was performed, breaking down the multivariate effects of perceptions of efficacy separately for SEFF and PTEFF. The effect of PTEFF on performance adaptability was significant for all multivariate tests, including Pillais' trace, $F(24, 292) = 1.89, p \leq .05$. The same analysis performed using SEFF was not significant for any of the multivariate tests including Pillais' trace, $F(24, 292) = 1.31, p > .10$. Thus, support for the effect of PTEFF on performance adaptability was obtained, but no support for the effects of SEFF was obtained. The results indicated that PTEFF at the end of

training was significantly related to performance adaptability, as indicated by score and penalty intrusions. These results provide strong support for Hypotheses 5 and 5a, which stated that PTEFF should influence performance adaptability.

Hypothesis 5a suggested that teams with members who were higher in PTEFF would exhibit greater performance adaptability than teams comprised of members who were lower in PTEFF. This hypothesis was supported with the obtained correlations and the multivariate tests, but it was further tested using the analyses designed to test both Hypotheses 5a and 5b. First, a RMR analysis was performed. Second, a regression analysis was performed, simultaneously regressing penalty intrusions on the adaptability task onto the perceptions of efficacy for each of the three team members. Third, a three level HLM analysis was performed to investigate the relationship between PTEFF and performance across trials, within each position, within each team.

The results of the RMR analyses are presented in Table 15. Ability was entered first, followed by PTEFF at the end of training, followed by SEFF, then the SEFF by PTEFF interaction. The RMR analyses were repeated by switching the order of entry for the efficacy perceptions. A multiple regression analysis was also performed on the penalty intrusions. This analysis is also presented in Table 15. Ability of the three members was entered, followed by either SEFF or PTEFF for the three members, followed by the interaction terms. It can be seen that PTEFF was significantly related to performance adaptability as measured by score and penalty intrusions, even after controlling for ability and SEFF. SEFF predicted above the effects of ability and PTEFF for penalty intrusions. All of the significant regression weights were in the hypothesized directions (e.g., positive for score, negative for intrusions). These analyses indicated that both SEFF and PTEFF

Table 15.

Effects of Perceptions of Efficacy on Performance AdaptabilityDependent Variable: Performance Adaptability (Score 6)

Total Observations = 231

Number of teams = 77

 $df_{Total} = 231$ $df_{BtwnTeam} = 76$ $df_{WithinTeam} = 154$ $R^2_{Y.BtwnTeam} = .378$ $R^2_{Y.WithinTeam} = .622$

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.052	.052		.083*	1
2	Pers Tm-Eff	.090	.038		.061*	1
3	Self-Efficacy	.091	.001		.002	1
4	PTEff x SEff	.092	.001		.001	1
Total		.092	.092	.000	.147*	4

Reverse Order of Entry for Self-Efficacy and Personal Team-Efficacy

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.052	.052		.083*	1
2	Self-Efficacy	.081	.029		.047*	1
3	Pers Tm-Eff	.091	.010		.017+	1
4	PTEff x SEff	.092	.001		.001	1
Total		.092	.092	.000	.147*	4

Dependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.223	.223	7.37*	3,77
2	Personal Tm-Efficacy	.300	.077	2.71*	3,74
3	Self-Efficacy	.358	.058	2.14+	3,71
4	PTEff x SEff	.366	.008	0.84	3,68
Total		.366	.366	2.68*	12,68

Table 15 (Cont'd).

Reverse Order of Entry for Self-Efficacy and Personal Team-EfficacyDependent Variable: Penalty Intrusions on Adaptability Task (PenInt6)

Step	Independent Variables	R ² for Equation	R ² Increment	F	df
1	Ability	.223	.223	7.37*	3,77
2	Self-Efficacy	.282	.059	2.03	3,74
3	Personal Tm-Efficacy	.358	.076	2.81*	3,71
4	PTEff x SEff	.366	.008	0.84	3,68
Total		.366	.366	2.68*	12,68

Note: * indicates $p \leq .05$, two-tailed
+ indicates $p \leq .05$, one-tailed

had significant and independent effects on performance adaptability. Efficacy perceptions predicted an additional four percent of the variance in performance adaptability score and an additional 14.3 percent of the variance in penalty intrusions, both after controlling for ability.

One alternative explanation for the effects of efficacy on the last training trial is that efficacy measures were surrogates for previous task performance. To some degree, this argument is addressed by partialling ability first. However, a three level HLM model was employed to provide more robust evidence against this argument. In the three level model, performance by trial was at the lowest level, cognitive ability was at the person level, and team characteristics were at the team level. Thus, performance was modeled at the trial level, using efficacy perceptions immediately preceding that trial as the predictor, with ability included in the equation at the person level. Because efficacy perceptions were modeled at the trial level and ability was controlled, it is more difficult to argue that efficacy perceptions were surrogates for previous performance. Also, because efficacy perceptions from earlier training trials were included in this analysis, it was more likely to discriminate the effects of the differential effects of SEFF and PTEFF.

The initial variance partitioning findings of the HLM analyses are presented at the top of Table 16. The sample sizes were slightly different from the earlier HLM analysis because of missing data, but the overall pattern of the variance partitioning was nearly identical. As before, most of the variance was within person over time (61.8 %). By definition, this variance had to come from processes unfolding within a person over time. There were also significant amounts of between person (29.1 %, $\chi^2 = 563.89$, $p \leq .05$) and between team variability (9.1 %, $\chi^2 = 139.37$, $p \leq .05$) in performance.

Table 16.

Three Level HLM Model of Efficacy and Performance by TrialIntercepts Only

$$\begin{aligned}\text{Level 1:} & Y_{ijk} = \pi_{0jk} + e_{ijk} \\ \text{Level 2:} & \pi_{0jk} = \beta_{00k} + r_{0jk} \\ \text{Level 3:} & \beta_{00k} = \gamma_{000} + u_{00k}\end{aligned}$$

Variance Components	Percent of Total	Reliability
σ^2 (score within person):	61.8	
Tau(π) (mean score within teams):	29.1	.633
Tau(β) (mean team differences):	9.1	1.000
Total variance:	100.0	

Fixed Effects	Coefficient	Standard error	t ratio	p value
Avg team mean, γ_{000}	897.25	36.68	24.46	0.000

Random Effects	Variance Component	df	χ^2	p value
Trials (level 1)	300456.59			
Individual members (level 2)	141346.95	176	563.89	0.000*
Teams (level 3)	43772.85	87	139.37	0.000*

Final Model

$$\begin{aligned}\text{Level 1:} & Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{SELF-EFFICACY}) + \pi_{2jk}(\text{PERSONAL TEAM-EFFICACY}) + e_{ijk} \\ \text{Level 2:} & \pi_{0jk} = \beta_{00k} + \beta_{01k}(\text{COGNITIVE ABILITY}) + r_{0jk} \\ & \pi_{1jk} = \beta_{10k} + \beta_{11k}(\text{COGNITIVE ABILITY}) + r_{1jk} \\ & \pi_{2jk} = \beta_{20k} + \beta_{21k}(\text{COGNITIVE ABILITY}) + r_{2jk} \\ \text{Level 3:} & \beta_{00k} = \gamma_{000} + u_{00k} \\ & \beta_{01k} = \gamma_{010} \\ & \beta_{10k} = \gamma_{100} \\ & \beta_{11k} = \gamma_{110} \\ & \beta_{20k} = \gamma_{200} \\ & \beta_{21k} = \gamma_{210}\end{aligned}$$

Variance Components	Variance Estimate	Reliability
σ^2 (residual):	245806.71	
Tau(π_0) (person effect on performance):	160414.61	.356
Tau(π_1) (person effect on self-eff slope):	4287.33	.004
Tau(π_2) (person effect on pers tm-eff slope):	51819.88	.042
Tau(β_{00}) (team effect on performance):	5523.06	1.000

Table 16 (Cont'd).

Fixed Effects	Coefficient	Std error	t ratio	p value
Average performance, γ_{000}	910.58	31.21	29.176	0.000*
<u>Person Effects on Performance</u>				
Cognitive Ability $\beta_{01k}, \gamma_{010}$	22.76	5.31	4.285	0.000*
Average self-eff slope, γ_{100}	184.97	39.95	4.630	0.000*
<u>Person Effects on Self-Eff Slope</u>				
Cognitive Ability $\beta_{11k}, \gamma_{110}$	-11.97	7.09	-1.689	0.091
Average pers tm-eff slope, γ_{200}	148.88	45.11	3.301	0.001*
<u>Person Effects on Pers Tm-Eff Slope</u>				
Cognitive Ability $\beta_{21k}, \gamma_{210}$	19.99	8.13	2.456	0.014*
Random Effects	Variance Component	df	χ^2	p value
Level 1 and Level 2				
Residual Variance (level 1), e_{ijk}	245806.71			
Person Differences in Performance, r_{0jk}	160414.61	105	380.76	0.000*
Person Differences in Self-Eff Slope, r_{1jk}	4287.01	181	184.99	0.404
Person Differences in Pers Tm-Eff Slope, r_{2jk}	51819.88	181	206.02	0.098
Level 3				
Team Differences in Performance, u_{00k}	5523.07	87	97.47	0.208

Note: * indicates $p \leq .05$, two-tailed

+ indicates $p \leq .05$, one-tailed

After the initial partitioning, a series of HLM models based on theoretical expectations were analyzed. In the first model, only PTEFF and ability was included. In the next model, only SEFF and ability was included. After inspection of the variance components, appropriate fixing of effects was performed following Bryk and Raudenbush's (1992) procedures. At this point both SEFF and PTEFF were included in the final model. The results are presented in the lower portion of Table 16. These analyses were repeated using the centering decisions suggested by Hofmann and Gavin (1996) with nearly identical results. It can be seen that cognitive ability, SEFF, and PTEFF all exerted independent and significantly positive effects on performance. Additionally, cognitive ability interacted with PTEFF such that those who were higher in cognitive ability and more efficacious about the team performed better than those who were low in ability or less efficacious. An interesting trend for an interaction between SEFF and cognitive ability was also observed. There is a possibility that those who are higher in ability and more efficacious about individual performance will do more poorly. This would be consistent with the notion that those who perform better as individuals become more self-focused, reducing the overall effectiveness of the team. Overall, there was strong support for the influences of efficacy on training performance and performance adaptability. The RMR, MR, MVMR, and HLM analyses all support Hypotheses 5 and 5a. There was no support for the interactive effects of SEFF and PTEFF on performance adaptability, providing no support for Hypothesis 5b.

Training outcomes. According to Hypotheses 6 and 6a, perceptions of efficacy are expected to be related to individually-oriented training outcomes like individual declarative

knowledge, coherence of knowledge structures, performance, and attitudes by the end of training. The first test of these hypotheses were performed using correlational analyses. Correlations were computed between efficacy perceptions on the final training trial and each of the outcomes measured after training was completed. These correlations are presented in Table 17. SEFF prior to the end of training was positively correlated with individual declarative knowledge, skill, SEFF and satisfaction at the end of training. Personal-team efficacy prior to the end of training was correlated with skill, SEFF, and satisfaction at the end of training. This provides initial support for Hypotheses H6 and H6a. Consistent with the HLM analyses, both SEFF and PTEFF were related to performance during training.

A MVMR model was tested by regressing the individual declarative knowledge, performance adaptability scores, coherence, and attitudes and affect onto SEFF and PTEFF across all four training trials. The multivariate significance tests are presented at the bottom of Table 17. All of the multivariate tests were significant, including Pillais' trace, $F(360, 810) = 1.40, p \leq .05$. Initial inspection of the univariate tests suggested the effects of efficacy were on skill, affective/attitudinal variables, and individual declarative knowledge. Consistent with the correlations, little evidence for the effects of efficacy on coherence was obtained.

A series of RMR analyses were performed, partialling ability first, then adding SEFF, PTEFF, and their interaction as predictors. After controlling for ability, SEFF was found to predict individual declarative knowledge ($\Delta R^2 = .015, \beta = .123, F = 4.12, p \leq .05$), but there was no evidence that PTEFF nor the interaction influenced individual declarative knowledge. With the exception of ability, none of the predictors for

Table 17.

Relationship Between Efficacy and Individually-Oriented Training Outcomes

	Individual Level		Team Level	
	<u>SEFF</u>	<u>PTEFF</u>	<u>SEFF</u>	<u>PTEFF</u>
Ind Declar Knowledge	.13*	.07	.22*	.17
Coherence of Know Struct	.04	.09	-.00	.09
Skill at End of Training	.20*	.16*	.31*	.25*
Self-Efficacy	.83*	.64*	.85*	.72*
Satisfaction	.18*	.29*	.41*	.44*

Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	5.67	1.40	360.00	810.00	.000*
Hotellings	27.11	2.87	360.00	572.00	.000*
Wilks	.00004	1.90	360.00	561.06	.000*
Roys	.894				

Note: * indicates $p \leq .05$, two-tailed

+ indicates $p \leq .05$, one-tailed

coherence were significant. Individual skill, as measured by score on the last training trial, was significantly predicted by efficacy perceptions, even after controlling for ability ($\Delta R^2 = .04$, $F = 5.46$, $p \leq .05$). However, neither SEFF nor PTEFF significantly predicted individual score after controlling for the effect of the other. This suggested efficacy perceptions near the end of training were strongly related to training performance, but effects were not distinguishable from each other. The interaction effect was not significant. SEFF and PTEFF during training predicted SEFF after training was completed, but only SEFF added incremental prediction after controlling for ability and other efficacy perceptions ($\Delta R^2 = .27$, $\beta = .794$, $F = 215.11$, $p \leq .05$).

A significant interaction effect between SEFF and PTEFF during training was obtained for effects on post-training SEFF ($\Delta R^2 = .01$, $\beta = .838$, $F = 6.60$, $p \leq .05$). This interaction is presented in Figure 26. The interaction effect was primarily carried by the effect of earlier SEFF on later SEFF for individuals high in PTEFF. If an individual was high in PTEFF but low in SEFF, they tended to have very low later SEFF. If they were high in PTEFF and high in SEFF, they tended to have high later SEFF.

Satisfaction was also predicted by efficacy perceptions. PTEFF during training predicted satisfaction after training, even after controlling for ability and SEFF ($\Delta R^2 = .06$, $\beta = .360$, $F = 14.74$, $p \leq .05$). SEFF did not add incremental prediction after controlling for PTEFF. The entire pattern of results provides partial support for Hypotheses 6 and 6a. Perceptions of efficacy were related to later individual declarative knowledge, individual skill, SEFF, and satisfaction. Limited support was obtained for Hypothesis 6b for interaction influences on SEFF. No other interaction effects were obtained.

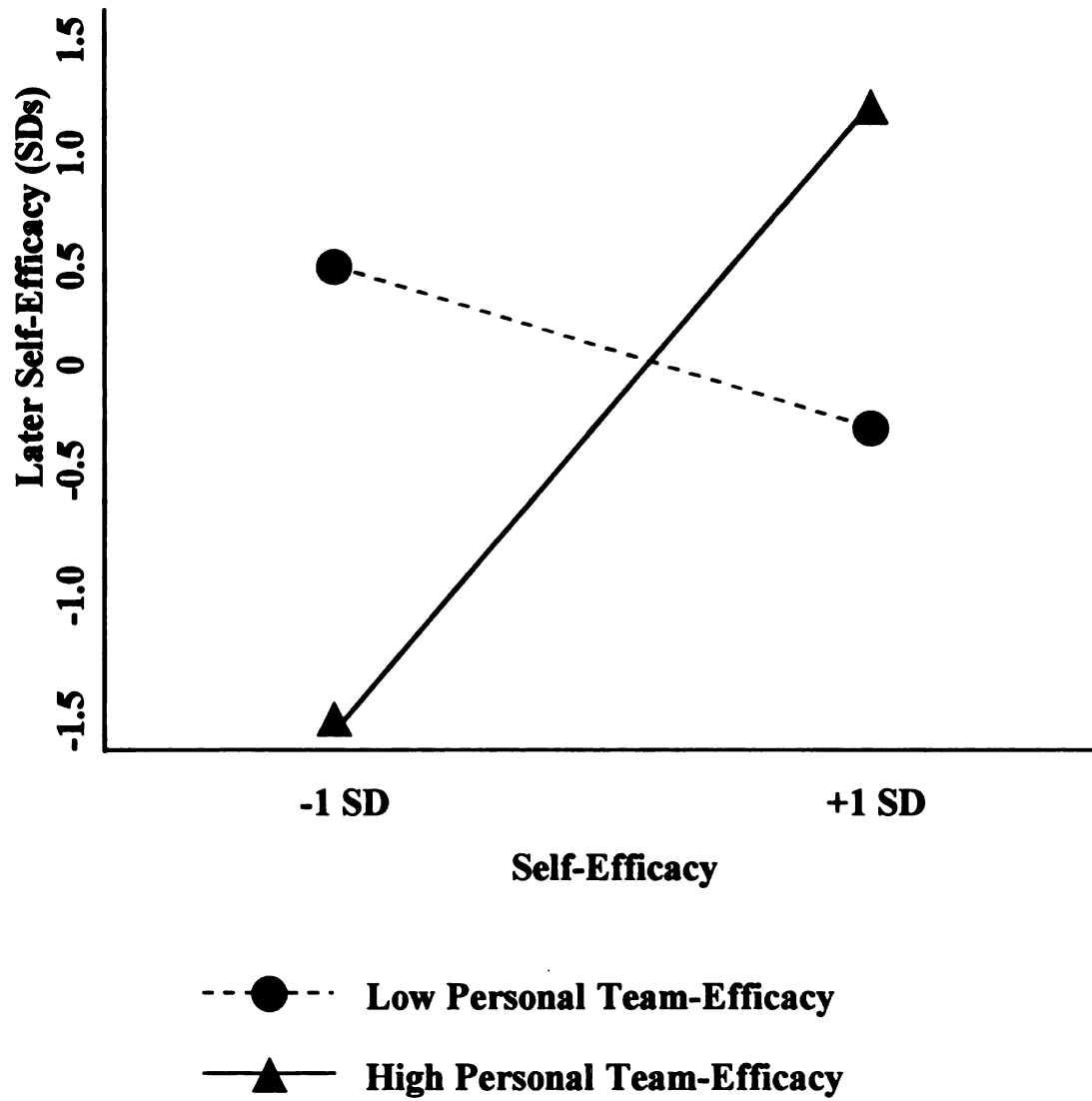


Figure 26. Interaction Effect of Self-Efficacy and Personal Team-Efficacy on Later Self-Efficacy

Hypothesis 7 stated that perceptions of efficacy would influence team-oriented training outcomes like team declarative knowledge, similarity of knowledge structures, and team-oriented affect and attitudes. Hypotheses 7a and 7b indicated that PTEFF and the SEFF by PTEFF interactions should influence team declarative knowledge. These hypotheses were tested using correlational, MVMR and RMR analyses.

First, correlations between efficacy perceptions and team declarative knowledge were computed at the individual and team levels. Limited support was obtained for the effect of PTEFF on team declarative knowledge. At the team level, PTEFF was significantly correlated with team declarative knowledge using a one-tailed test ($r = .19$, $p \leq .05$, one-tailed). A MVMR model was tested by regressing the scores for team declarative knowledge by position onto SEFF and PTEFF by position and trial. The multivariate significance tests provided no overall support for the effect of efficacy on team declarative knowledge. None of the multivariate tests were significant, including Pillais' trace, $F(36, 204) = 0.891$, $p > .10$.

A series of RMR analyses were performed to test for the potential interactive effects of SEFF and PTEFF on team declarative knowledge. Ability was partialled first, followed by SEFF, PTEFF, and their interaction. No significant effects were obtained. Thus, although there was a weak correlation between PTEFF and team declarative knowledge, there was very little support for Hypotheses 7a and 7b.

Hypothesis 7c suggested that teams comprised of members who were higher in PTEFF during training would exhibit greater sharedness of knowledge structures and greater team skill by the end of training. This was tested using correlational, MVMR, and MR analyses. Correlations between PTEFF and SEFF just prior to the last training trial

and sharedness and team skill after training were computed at individual and team levels and are presented along with other team-oriented outcomes in Table 18.

The particular correlations of interest for Hypothesis 7c were the correlations between SEFF and PTEFF just prior to the final training trial and similarity and team score. Perceptions of efficacy just prior to the last training trial were not significantly correlated with sharedness. Although not presented in the table, perceptions of SEFF and PTEFF on the very first training trial were significantly correlated with measures of similarity at the end of the second day of training ($r = .14$ and $.15$, respectively, $p \leq .05$). A MVMR analysis using measures of sharedness as dependent variables and perceptions of efficacy across trials as predictors detected significant effects, Pillais' trace, $F(36, 198) = 1.68$, $p \leq .05$, supporting the hypothesis that perceptions of efficacy would influence similarity. However, neither SEFF nor PTEFF significantly predicted sharedness after controlling for the effects of the other.

Both SEFF and PTEFF were correlated with skill across trials, using both individual scores and team scores. Because individual scores are strongly related to team scores they are a useful index of team skill by the end of training. This replicates the earlier findings for influences of efficacy on skill. The MVMR analysis for the simultaneous prediction of team score and similarity from all self- and personal team- efficacy perceptions across trials was significant for all multivariate tests, including Pillais' trace, $F(108, 603) = 2.50$, $p \leq .05$. The entire pattern of findings provided strong support for the effects of efficacy on skill, and some support for the effects of efficacy on similarity. The multivariate effect size for effects of efficacy on similarity was $.234$. Overall, support for Hypothesis 7c was obtained.

Table 18.

Relationship Between Efficacy and Team-Oriented Training Outcomes

	Individual Level		Team Level	
	<u>SEFF</u>	<u>PTEFF</u>	<u>SEFF</u>	<u>PTEFF</u>
Team Dec Knowledge	.06	.03	.14	.19+
Similarity of Know Struct	.07	.06	.12	.08
Team Skill	.20*	.16*	.31*	.25*
Personal Team-Efficacy	.76*	.78*	.82*	.83*
Social Cohesion	.11+	.17*	.23*	.35*
Task Cohesion	.20*	.28*	.33*	.40*

Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	2.78	2.50	108.00	603.00	.000*
Hotellings	9.64	5.10	108.00	515.00	.000*
Wilks	0.00968	3.65	108.00	442.05	.000*
Roys	0.834				

Note: * indicates $p \leq .05$, two-tailed
 + indicates $p \leq .05$, one-tailed

Hypothesis 7d suggested that an interaction of SEFF and PTEFF would be obtained for their effects on sharedness and team skill. This was tested using MR. First, ability by position was entered, followed by the entry of PTEFF for each position. This was followed by SEFF and then the interaction terms by position. PTEFF was found to predict team skill after controlling for ability ($\Delta R^2 = .04$, $\beta = .212$, $F = 4.28$, $p \leq .05$). However, no interaction effects for similarity or team skill were obtained, providing no support for Hypothesis 7d.

Hypotheses 7e and 7f suggested earlier perceptions of efficacy would influence later team-oriented affect and attitudes. The correlations in Table 18 support Hypothesis 7e. Efficacy perceptions were consistently and strongly correlated with a variety of affective and attitudinal variables. A MVMR analysis was performed in which perceptions of efficacy by position and trial were used to predict social cohesion, task cohesion, and PTEFF at the end of training. All of the multivariate tests were significant, including Pillais' trace, $F(108, 603) = 2.50$, $p \leq .05$. Strong support for Hypothesis 7e was obtained.

A series of RMR analyses were performed to test for potential interactions between SEFF and PTEFF in effects on team-oriented affect and attitudes. Ability was partialled first, but it did not predict a significant amount of variance for any of the affectively oriented variables. In each case, PTEFF predicted a significant amount of variance in later PTEFF ($\Delta R^2 = .10$, $\beta = .484$, $F = 76.29$, $p \leq .05$), social cohesion ($\Delta R^2 = .02$, $\beta = .222$, $F = 5.28$, $p \leq .05$), and task cohesion ($\Delta R^2 = .04$, $\beta = .300$, $F = 10.20$, $p \leq .05$).

.05), even after controlling for ability and SEFF. No support for Hypothesis 7f was obtained, but these analyses provide further support for Hypothesis 7e.

Goals. Hypotheses 8 and 8a suggested efficacy perceptions should be related to self-setting of INDGLS. Hypothesis 8b indicated that SEFF and PTEFF would interact to influence self-setting of INDGLS. The relationship between efficacy and individual goal setting was initially analyzed by computing correlations at the individual and team level, and also by performing a MVMR analysis. It should be noted, however, that this analysis does not establish whether efficacy perceptions predict goals, for it can only establish that they are related. As can be seen in Table 19, nearly all efficacy perceptions and goals at both levels were significantly correlated with each other. Furthermore, the MVMR analysis for INDGLS was significant, demonstrating that some combination of SEFF and PTEFF perceptions were related to self-setting of INDGLS. These analyses were sufficient to establish initial support for Hypotheses 8 and 8a.

A series of RMR analyses were performed to determine if efficacy perceptions predicted goals by investigating the incremental contribution of efficacy perceptions. Consistent with previous analyses, ability was entered first. Next, the level of self-set INDGLS from the trial immediately preceeding the INDGLS of interest were entered. Next, either SEFF or personal team- efficacy was entered. The order of entry for the efficacy variables was also reversed to determine incremental contribution to R^2 for each. Finally, the interaction between the two variables was entered in the final step. It was found even after controlling for ability, previous goal levels, and SEFF, that PTEFF significantly incrementally predicted INDGLS on the second and third trials. SEFF and the interaction did not predict INDGLS on the second trial. Ability, SEFF, and the interaction

Table 19.

Relationship Between Efficacy and GoalsIndividual Level Correlations:

	<u>Seff1</u>	<u>Pteff1</u>	<u>Seff2</u>	<u>Pteff2</u>	<u>Seff3</u>	<u>Pteff3</u>
Igoal2	.40*	.32*	.55*	.40*	.30*	.21*
Tgoal2	.30*	.42*	.41*	.49*	.20*	.25*
Igoal3	.27*	.19*	.39*	.35*	.41*	.33*
Tgoal3	.27*	.32*	.36*	.44*	.38*	.39*
Igoal4	.25*	.19*	.31*	.29*	.39*	.32*
Tgoal4	.27*	.31*	.32*	.38*	.33*	.35*

Team Level Correlations:

	<u>Seff1</u>	<u>Pteff1</u>	<u>Seff2</u>	<u>Pteff2</u>	<u>Seff3</u>	<u>Pteff3</u>
Igoal2	.47*	.42*	.61*	.51*	.33*	.26*
Tgoal2	.39*	.50*	.50*	.60*	.25*	.26*
Igoal3	.32*	.20+	.36*	.31*	.35*	.29*
Tgoal3	.33*	.34*	.37*	.44*	.36*	.40*
Igoal4	.33*	.19+	.26*	.19+	.29*	.24*
Tgoal4	.36*	.40*	.36*	.42*	.33*	.40*

MVMR for Efficacy Perceptions and Individual Goals:Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	3.93	1.35	216.00	600.00	.003*
Hotellings	8.69	1.50	216.00	446.00	.000*
Wilks	.00382	1.44	216.00	419.99	.001*
Rois	.700				

MVMR for Efficacy Perceptions and Team Goals:Multivariate Tests of Significance

<u>Test Name</u>	<u>Value</u>	<u>Approx. F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig</u>
Pillais	4.18	1.52	216.00	612.00	.000*
Hotellings	9.26	1.64	216.00	458.00	.000*
Wilks	.00262	1.61	216.00	430.03	.000*
Rois	.712				

did not significantly predict goals on the third trial. The results of the regressions are presented in Table 20. The findings provide support for Hypothesis 8, but not for 8a nor 8b. Hypothesis 8a was not supported because it stated that SEFF would predict individual goal setting when it was found that PTEFF predicted individual goal setting. Hypothesis 8b was not supported because there was no evidence for interaction effects.

Hypotheses 9 and 9a suggest efficacy perceptions should be related to self-setting of TMGLS. Hypothesis 9b indicated that SEFF and PTEFF would interact to influence self-setting of TMGLS. The relationship between efficacy and team goal setting was initially analyzed by computing correlations at the individual and team level, and also by performing a MVMR analysis. Results are presented in Table 19. As with INDGLS, efficacy perceptions were strongly related to self-setting of team goals. These analyses are sufficient to establish existence of a relationship so a series of RMR analyses were performed.

The RMR analyses were performed to determine if efficacy perceptions predicted TMGLS by investigating the incremental contribution of efficacy perceptions. Ability was entered, followed by TMGLS on the preceeding trial. This was followed by either SEFF or PTEFF; order was reversed to assess the unique contribution of each. The interaction between the two variables was entered in the final step. Results are presented in Table 21. Regardless of order of entry, PTEFF predicted self-setting of TMGLS on the second the third trials, even after controlling for ability, previous goal levels, and SEFF. SEFF predicted TMGLS on the third trial, but not if PTEFF was entered first. The findings provide support for Hypotheses 9 and 9a. No support was obtained for 9b, which hypothesized an interaction effect between SEFF and PTEFF.

Table 20.

Effects of Efficacy on Individual GoalsDependent Variable: Individual Goals Trial 2

Total Observations = 258

 $df_{Total} = 257$ $df_{WithinTeam} = 172$ $R^2_{Y.BtwnTeam} = .397$

Number of teams = 86

 $df_{BtwnTeam} = 85$ $R^2_{Y.WithnTeam} = .603$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.011	.011		.019*	1
2	Ind Goals 1	.505	.494		.818*	1
3	Self-Eff	.507	.002		.003	1
4	Pers Tm-Eff	.515	.008		.013*	1
5	SEff x PTmEff	.517	.001		.002	1
Total		.517	.517	.000	.855*	5

Dependent Variable: Individual Goals Trial 3

Total Observations = 258

 $df_{Total} = 257$ $df_{WithinTeam} = 172$ $R^2_{Y.BtwnTeam} = .397$

Number of teams = 86

 $df_{BtwnTeam} = 85$ $R^2_{Y.WithnTeam} = .603$

Step	Independent Variables	R^2 for Equation	R^2 Increment	Increment Between	Increment Within	df
Within						
1	Ability	.000	.000		.000	1
2	Ind Goals 2	.504	.504		.795*	1
3	Self-Eff	.504	.000		.001	1
4	Pers Tm-Eff	.512	.008		.013*	1
5	SEff x PTmEff	.513	.001		.001	1
Total		.513	.513	.000	.810*	5

Note: * indicates $p \leq .05$, two-tailed+ indicates $p \leq .05$, one-tailed

Table 21.

Effects of Efficacy on Team GoalsDependent Variable: Team Goals Trial 2

Total Observations = 258

Number of teams = 86

 $df_{Total} = 257$ $df_{BtwnTeam} = 85$ $df_{WthnTeam} = 172$ $R^2_{Y.BtwnTeam} = .453$ $R^2_{Y.WthnTeam} = .547$

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.000	.000		.000	1
2	Tm Goals 1	.422	.422		.772*	1
3	Self-Eff	.424	.002		.003	1
4	Pers Tm-Eff	.459	.035		.064*	1
5	SEff x PTmEff	.460	.001		.001	1
Total		.460	.460	.000	.840*	5

Dependent Variable: Team Goals Trial 3

Total Observations = 258

Number of teams = 86

 $df_{Total} = 257$ $df_{BtwnTeam} = 85$ $df_{WthnTeam} = 172$ $R^2_{Y.BtwnTeam} = .389$ $R^2_{Y.WthnTeam} = .611$

Step	Independent Variables	R ² for Equation	R ² Increment	Increment Between	Increment Within	df
Within						
1	Ability	.002	.002		.003	1
2	Tm Goals 2	.438	.436		.714*	1
3	Self-Eff	.451	.013		.022*	1
4	Pers Tm-Eff	.459	.008		.013*	1
5	SEff x PTmEff	.460	.001		.002	1
Total		.460	.460	.000	.754*	5

Note: * indicates $p \leq .05$, two-tailed+ indicates $p \leq .05$, one-tailed

Effects of Feedback

Performance adaptability. Hypotheses 10, 10a, and 10b all suggest individual and team feedback should influence performance adaptability. Hypothesis 10a suggested that teams with members receiving team feedback would perform better on a performance adaptability task than would teams which do not receive such feedback. Hypothesis 10b suggested an interaction effect would be obtained such that individual and team feedback together would result in the highest levels of performance. It might be remembered that all teams had access to diagnostic feedback so that learning opportunities were equated across conditions. A repeated measures MANOVA (RMMANOVA) was performed using the scores on the adaptability task from each of the three positions as related dependent variables. A regular ANOVA was also performed using penalty circle intrusions. These analyses provided tests for Hypotheses 10, 10a, and 10b, and are presented in Table 22.

Results of the RMMANOVA and ANOVA both indicate that team feedback was positively associated with performance adaptability as measured by individual scores and penalty intrusions on the adaptability task. A follow-up analysis was performed by partialling cognitive ability scores as a covariate. Although ability significantly predicted performance adaptability, the effects of team feedback remained significant and results replicated the initial analysis. An ANOVA using team score as the dependent variable also replicated the RMMANOVA analysis. There was no evidence for an interaction effect between individual feedback and team feedback for any of the analyses. These findings provide support for Hypotheses 10 and 10a. However, no support was obtained for Hypothesis 10b. Although not presented, a series of HLM models replicated the MANOVA and ANOVA findings.

Table 22.

Effects of Feedback on Performance AdaptabilityRMMANOVA for Performance Adaptability Scores by PositionBetween Team Effects

Source	SS	df	MS	F	Sig
IND FB	93992.54	1	93993	.04	.847
TM FB	17068432.66	1	17068433	6.82	.011*
IND x TM FB	5853353.50	1	5853354	2.34	.130
Error	192724254.50	77	2502912		

Within Team Effects

Source	SS	df	MS	F	Sig
POSITION	22068580.61	2	11034290	5.29	.006*
IND FB x POS	1240178.67	2	620089	.30	.743
TM FB x POS	5568112.26	2	2784056	1.33	.266
INDxTMxPOS	8882349.12	2	4441175	2.13	.123
Error	321341864.90	154	2086636		

ANOVA for Penalty Intrusions

Source	SS	df	MS	F	Sig
IND FB	.00	1	.00	.00	.992
TM FB	36.12	1	36.12	4.04	.048*
IND x TM FB	14.97	1	14.97	1.67	.200
Error	688.46	77	8.94		

Training outcomes. Hypotheses 11, 11a, and 11b suggested that individual and team feedback would influence individually-oriented training outcomes like individual declarative knowledge, coherence, and individual skills. Hypothesis 11a indicated presence of individual feedback would lead to higher levels of individual training outcomes. Hypothesis 11b suggested individual and team feedback would interact such that when both were present, the highest levels of training outcomes would be obtained.

A series of RMMANOVA analyses were performed with individual measures nested within the teams for individual declarative knowledge, coherence, and individual skill as measured by training performance. None of the effects of feedback on coherence and individual declarative knowledge were significant. Team feedback had a positive and significant influence on individual scores during training, $F(1, 77), 4.94, p \leq .05, h^2 = .07$.

The effects of feedback on performance during training was further analyzed using HLM analyses. The effect of team feedback was positive and consistent across trials, but there was no evidence for a feedback interaction effect. There was some evidence that individual feedback might have a negative impact on performance. Due to space considerations and because the HLM analyses replicated the RMMANOVA analyses, the results are not presented. Overall, no support for Hypotheses 11, 11a, and 11b was obtained. However, it was determined that team feedback had a positive effect on individual skill.

Hypothesis 12 suggested that individual and team feedback would influence team-oriented training outcomes like team declarative knowledge, sharedness of knowledge structures, and team skills. Hypothesis 12a suggested that team feedback would have a positive impact on team declarative knowledge, and Hypothesis 12b suggested individual

and team feedback would interact such that when both were present the highest levels of team declarative knowledge would be obtained. Hypotheses 12a and 12b were tested using RMMANOVA where declarative knowledge scores were nested within teams. None of the effects of feedback on team declarative knowledge were significant, but individual feedback had a marginally significant negative effect on team declarative knowledge ($r = -.11$, $p \leq .07$). There was no evidence for an interaction effect.

Hypothesis 12c suggested team feedback would lead to higher levels of sharedness of knowledge structures and higher team skill during training. Hypothesis 12d suggested individual and team feedback would interact such that the presence of both would lead to the highest levels of sharedness and team skill. The hypotheses for sharedness were tested using RMMANOVA with similarity scores nested within teams. This analysis was replicated using ANOVA with mean similarity as the dependent variable. There was no evidence that either individual feedback, team feedback, or the interaction had a significant effect on similarity scores for either of the analyses. The lack of significant effects were corroborated in the correlations between feedback and similarity scores.

An ANOVA was performed for the effects of feedback on team performance during training. Consistent with previous findings, team feedback had a significant positive impact on team performance during training, $F(1, 77), 3.32, p \leq .05$. This provided partial support for Hypothesis 12c. There was no interaction effect, providing no support for Hypothesis 12d. A RMMANOVA with scores over time with teams was performed. A significant interaction between trials and team feedback was obtained, further supporting the positive effects of team feedback on performance during and after training.

DISCUSSION

The organization of the discussion will proceed as follows. First, primary findings of interest will be summarized and elaborated. Second, implications of the findings for research on training in individual and team contexts will be discussed. Third, applied implications will follow the discussion of research implications. Finally, the discussion will close by considering various limitations of the current study and future research directions.

Summary of Findings

Cognitive ability. The first finding to be highlighted is that cognitive ability was consistently and strongly related to performance adaptability as well as a variety of individual and team training outcomes. In particular, ability was strongly positively related to declarative knowledge, structural knowledge, and skill. Additionally, ability was significantly correlated with early measures of self-efficacy (SEFF) and personal team-efficacy (PTEFF). This is an important point as many training and motivational studies do not explicitly consider the incremental effects of design factors or motivational variables after controlling for ability (Phillips & Gully, in press). As a result, it is not clear what value constructs like efficacy perceptions add beyond ability for understanding behavior and performance. In the current study, ability was partialled prior to investigating the effects of self-regulatory variables on training outcomes and performance adaptability. If ability was not partialled first, then the previous level of the construct of interest was

partialled. This made all of the tests in the current study conservative, yet theoretically valuable for determining the unique impacts of the variables. For example, if performance adaptability and training outcomes are not due to ability, then it stands to reason they are due to other factors like learning and self-regulatory processes. Evidence supporting hypotheses using these stringent tests provides strong support for the underlying conceptual model.

The entire pattern of findings obtained in the study is generally consistent with expected relationships based on the conceptual model presented in Figure 5. Each outcome of training was significantly correlated with performance adaptability. The training outcomes, both individually- and team-oriented, were strongly related to various indices of performance adaptability both before and after controlling for ability.

Individual training outcomes. Individual training outcomes predicted an additional 11.6% of the variance in score and 21% of the variance in penalty intrusions after controlling for ability. Cognitive training outcomes like individual declarative knowledge and coherence were particularly strongly related to penalty intrusions. Affective and attitudinal variables significantly predicted performance adaptability even after controlling for both cognitive training outcomes and cognitive ability.

Team training outcomes. Team-oriented training outcomes like team declarative knowledge, sharedness of knowledge structures, PTEFF, and cohesion predicted performance adaptability after controlling for ability and individually-oriented training outcomes in various analyses. Also, the results indicated that SEFF and PTEFF were more distinguishable constructs early during team training, but they converged and became strongly related by the end of training. In earlier trials, PTEFF tended to be more strongly

predictive of training outcomes than was SEFF. Similar effects were observed for individual goals (INDGLS) and team goals (TMGLS), but the trend was much weaker and less consistent.

These findings support the Kraiger, Ford, and Salas (1993) multidimensional view of training outcomes. This study is the first extension of their theory to team training contexts. Team declarative knowledge, sharedness of knowledge structures, and PTEFF are all important training outcomes for ensuring team adaptability.

Goals. Self-regulatory variables like goals, efficacy, and feedback generally led to higher levels of performance adaptability and more positive training outcomes. Goals predicted performance adaptability after controlling for ability, but the effects of individual goals (INDGLS) or team goals (TMGLS) were not readily distinguishable from each other. TMGLS were more strongly related to penalty intrusions than were INDGLS, but in general, neither goal predicted more than the other. In retrospect, this might be expected for groups or teams performing highly interdependent tasks. It is possible that self-set INDGLS and TMGLS will have different effects on tasks of varying complexity and task interdependence.

These findings are in contrast to previous studies which suggest that goals do not predict performance on complex tasks (Locke & Latham, 1990; Wood et al., 1987). The team task performed by the members was highly complex, yet higher INDGLS or TMGLS led to higher levels of performance on each trial and on the adaptability task. One likely cause for the discrepancy in findings is that most goal setting studies have employed assigned goals on complex tasks whereas goals were self-set in the current study. Future

research might pursue this possibility to disentangle the influences of self-set goals from assigned goals on complex tasks, particularly in team environments.

Goals were also related to individually-oriented training outcomes. Higher INDGLS were associated with higher levels of individual declarative knowledge. Higher levels of self-set INDGLS or TMGLS during training led to higher levels of skill and performance by the end of training. Additionally, meeting or exceeding INDGLS earlier in training created higher levels of efficacy by the end of training. However, although ability was positively related to coherence, goals were not related to coherence of knowledge structures.

Goals were related to a variety of team-oriented training outcomes. Higher levels of ability and INDGLS were positively related to later team declarative knowledge. There was evidence that INDGLS and TMGLS created greater levels of sharedness in knowledge structures among team members, but this evidence was inconsistent. TMGLS were consistently related to training skill and performance after controlling for ability.

Goals had an effect on affective/attitudinal variables. Meeting or exceeding either INDGLS or TMGLS led to higher levels of later PTEFF. Additionally, an interaction effect for meeting or exceeding INDGLS and TMGLS on PTEFF was obtained. Specifically, later PTEFF was highest when both INDGLS and TMGLS were met or exceeded during training. An unexpected interaction effect for task cohesion was also obtained such that the highest levels of later task cohesion resulted from failing to exceed both INDGLS and TMGLS.

Efficacy perceptions. Efficacy perceptions had important effects on performance adaptability, training outcomes, and self-set goal levels. SEFF predicted penalty intrusions

on the adaptability task after controlling for ability. Overall, efficacy perceptions predicted an additional 14.3% of the variance in penalty intrusions. Additionally, PTEFF had positive effects on performance adaptability beyond those of SEFF and ability. Finally, PTEFF interacted with ability to influence performance during training. People who were high in PTEFF and ability did better than those who were low in one, the other, or both.

Higher levels of efficacy perceptions led to higher levels of a variety of training outcomes. SEFF predicted individual declarative knowledge, but there was no evidence that PTEFF predicted individual declarative knowledge. Consistent with the goal effects, neither form of efficacy predicted coherence of knowledge structures. Both forms of efficacy were strongly related to individual skill during training, but neither predicted after controlling for the effects of the other. Earlier levels of efficacy were related to later attitudes and affect. Early SEFF predicted later SEFF even after controlling for ability and PTEFF. There was also a significant interaction effect such that individuals who were high in PTEFF but low in SEFF had the lowest levels of SEFF on later trials. This effect may have been due to some form of normative or social comparison effect. Conversely, those who were high in PTEFF and high in SEFF had the highest levels of SEFF on later trials. Finally, PTEFF predicted satisfaction at the end of training, but SEFF did not.

Efficacy perceptions also had a variety of influences on team-oriented training outcomes. Generally speaking, neither SEFF nor PTEFF exerted unique effects on team training outcomes. Early efficacy perceptions were related to later sharedness of knowledge structures. Efficacy perceptions were also strongly related to individual and team skill during and at the end of training. This remained true even when holding ability constant. Although the effect of cognitive ability was significant, neither SEFF nor PTEFF

predicted the level of team declarative knowledge at the end of training. Higher levels of PTEFF led to higher levels of positive affective and attitudinal variables. This was true even after controlling for ability and SEFF.

PTEFF had an effect on the self-setting of INDGLS and TMGLS, even when ability and SEFF were held constant. In particular, higher levels of PTEFF led to higher self-set INDGLS and TMGLS during training.

Feedback. Feedback was another self-regulatory variable that had an impact on performance adaptability and skill acquisition during training. Presence of team feedback yielded higher levels of performance adaptability and led to improved rates of skill acquisition during training. There was no evidence that the feedback manipulations influenced the individual cognitive training outcomes of individual declarative knowledge and coherence. However, there was slight evidence that the presence of individual feedback yielded lower levels of team declarative knowledge. This finding is consistent with the weak negative correlations obtained between individual feedback and skill during training. Overall, there was little evidence that feedback influenced individual and team cognitive outcomes of training. This may have been due to the presence of diagnostic feedback for all teams in all conditions, which was a primary source of learning for team members. However, significant effects on training skill and performance adaptability were obtained in spite of the fact that feedback manipulations were intentionally weakened by equating groups on access to important learning information. Also, feedback operated to influence performance through a chain of self-regulatory variables, potentially masking or reducing its observable effects because of its indirect relationship with performance, yet significant findings were still obtained.

Although the basic findings of this study are summarized above, elaboration and explanation of these findings will be discussed in the following sections. Implications of findings for research will be examined, followed by implications for practice. Finally, the discussion will close with an examination of study limitations along with suggestions for future research directions.

Research Implications

Levels. In the introduction it was pointed out that although there is much theory and research regarding the training of individual skills, there is little research or theory regarding the training of team related knowledge and behaviors which bring individual skills and capabilities together into an integrated and well-coordinated team (Kozlowski, Gully, McHugh et al., 1996; Salas et al., 1992; Shiflett et al., 1982). A model of learning in team environments was proposed and supported that linked individual self-regulatory processes to key training outcomes in team contexts.

The perspective taken in the theoretical model is that it is the individuals within the teams that learn. Teams are comprised of individuals, but teams do not, by themselves cognize, behave, or react (James et al., 1988). Individuals in teams perceive, learn, and react to stimuli (Hackman, 1992). Thus, it becomes crucial to identify the specific forms of learning, skill, and affect or attitudes that create enabling conditions for team adaptability. Additionally, if primary outcomes of team training can be identified and linked to regulatory processes within members of teams, then future team training systems can effectively take advantage of this information. This is a shift from typical research efforts to understand team training and processes because it focuses on the cumulative effect of the individuals within the team on overall team performance. This is the first model and

empirical test specifying the cross-level link between individual self-regulatory processes, individual learning, and team performance.

The shift to a cross-level perspective of individual level self-regulatory influences on training outcomes and aggregate performance is important theoretically. It enables researchers to consider how individual level attributes like cognitive ability, personality, and experience can influence aggregate performance of higher level entities like teams and organizations. Theory-building for such relationships is impeded by considering team members and team processes only as part of an undifferentiated whole. For example, although Prussia and Kinicki (1996) did a nice study demonstrating links between collective-efficacy, goals, and performance, their study remained entirely focused on aggregate units. Such an approach prevents the study of the interplay between individual and team goals, self-efficacy and personal team-efficacy, and individual differences on performance. It is for this reason that empirical validation of a cross-level model of self-regulatory processes and team training outcomes is useful and theoretically important.

The implication of these findings is that future research should continue to explore how individual level processes map onto aggregate outcomes. Additionally, it becomes important to consider how team level interventions interact with and differentially influence individual team members. For example, if an intervention works for all of the members of an interdependent team except for one or two key members, then the intervention is likely to fail for the team as a unit. Failure of an intervention for even one key member would likely disrupt internal team processes, coordinated task flows, and ultimately, team performance. However, it would be impossible to understand the source of failure in the intervention without looking at the impact of the training intervention on

the self-regulatory processes of each of the various members within teams. This is a perspective simply not addressed in research that only investigates groups or teams as aggregate units.

Training outcomes. The findings indirectly support the notion that declarative knowledge forms the foundation for the acquisition of more advanced knowledge and skills (Anderson, 1982, 1983; Glaser & Bassok, 1989; Kanfer & Ackerman, 1989). Measures of knowledge structure like coherence and similarity predicted performance adaptability after controlling for ability and declarative knowledge, indicating that coherence and similarity explain performance beyond declarative knowledge. Thus, it is likely that declarative knowledge does not encompass the deeper relational characteristics of coherence and sharedness. This suggests that a focus on training outcomes using criteria like simple multiple choice tests overlook other important forms of learning which occur during training experiences. Also, it seems that the acquisition of declarative knowledge was determined by processes which were distinct from those leading to coherence of knowledge structures. Declarative knowledge was primarily influenced by cognitive ability, goals, and efficacy. Coherence, in contrast, was primarily predicted only by ability. This supports the suggestion by Lord and Maher (1991) that declarative knowledge is acquired through processes that may be distinct from those leading to the acquisition of more expert skills.

Training has often focused on the individual level (Feldman, 1989). Research suggests that cognitive, skill-based, and affective variables may be crucial as training outcomes at the individual level (Kraiger et al., 1993). This study advances our knowledge by extending this framework to training outcomes at the team level. Findings indicate that

outcomes of individual training are not sufficient to understand skill acquisition in team training contexts.

For example, McIntyre and Salas (1995) suggest that basic knowledge of the tasks of others with whom members interact during team operations is an important form of knowledge for team members. Similarly, Baker (1991) found lack of knowledge regarding other member roles negatively influenced teamwork and task performance (Baker et al., 1992). The positive findings for team declarative knowledge support these previous studies, but they also demonstrate that team declarative knowledge is important even after controlling for individual positional knowledge and ability.

Cannon-Bowers and colleagues identified team competencies as (1) requisite knowledge, principles, and concepts underlying a team's effective task performance; (2) a repertoire of required skills and behaviors necessary to perform the task effectively; and (3) appropriate attitudes on the part of team members that foster effective team performance (Cannon-Bowers et al., 1995). Prior to the current investigation, no empirical study has attempted to investigate the simultaneous impact of these variables on team adaptability, particularly after controlling for ability. Cognitive, skill-based, and affective variables were all found to be critical factors for team effectiveness.

An important finding was that both individual training outcomes like individual declarative knowledge, coherence, and SEFF and team training outcomes like team declarative knowledge, sharedness, and PTEFF were important for performance adaptability. This indicates that the Kraiger et al. (1993) model must be further elaborated when considering training systems in situations where more than one focal level is of interest.

Feldman (1989) noted training systems and socialization processes in organizations often have much overlap. Both training and socialization processes can develop knowledge and skills, create an understanding of role behaviors, and adjust values and attitudes of newcomers (Feldman, 1981, 1989; Van Maanen & Schein, 1979). Findings from this study suggest the criteria for successful training and socialization efforts in organizations must be broadened to include knowledge, skills, and affect related to levels of analysis higher than the individual if the concern is on integration of individuals into teams, departments, or organizations.

Findings also extend previous work on the impact of knowledge structures in individual learning environments (Goldsmith & Johnson, 1990; Goldsmith et al. 1991; Kozlowski et al., 1995; Kraiger, 1993; Nason et al., 1995). Emerging theory and previous findings regarding the importance of shared mental models for understanding team effectiveness and adaptability (Cannon-Bowers et al., 1990, 1993; Kleinman & Serfaty, 1989; Klimoski & Mohammed, 1994; Minionis et al., 1995; Rentsch et al., 1994) were further supported by the findings obtained in this study. Performance of interdependent tasks is facilitated by the sharing of important forms of knowledge and skills. However, one unique contribution of the current study was the demonstration that sharedness of knowledge structures had a unique impact on adaptability even after controlling for ability, declarative knowledge, and coherence. This is a stringent test and strongly suggests that sharedness of knowledge, as measured by similarity indices, captured a unique form of team-related knowledge.

Numerous studies have demonstrated that individual affective/attitudinal variables like SEFF are important outcomes of training (Kraiger et al., 1993). Similarly, some

theorists have suggested that attitudinal or affective variables regarding the team are important types of team competencies (Cannon-Bowers et al., 1995). This study demonstrated that attitudinal and affective variables like social cohesion, task cohesion, and PTEFF are important outcomes of team training. However, it also demonstrated that SEFF and PTEFF converged over the course of training on an interdependent task. Effects of each were distinguishable early during training but they became a single generalized perception of capability by the end of training. It was also found that ability generally did not predict affective and attitudinal variables, but these variables were quite important for predicting team adaptability.

Future research could begin to investigate other possible outcomes of team training. For example, there are many different forms of declarative knowledge which can be assessed using a variety of methods. Future studies might begin to identify which methods of measurement and forms of team declarative knowledge are most useful for understanding team effectiveness. Alternative measures of shared knowledge could also be pursued, including concept mapping and multidimensional scaling procedures (Rentsch et al., 1994). It is possible that different measures will capture unique forms of sharedness. Additionally, the current study did not explicitly measure communication, cooperation, and coordination skills. Future research efforts might attempt to identify the specific role that these skill-based outcomes of training have for facilitating team adaptability. Other forms of affective and attitudinal variables besides efficacy, satisfaction, and cohesion are probably important for team adaptability. It would be important to identify which other affective and attitudinal variables facilitate or inhibit performance adaptability. Finally, there was some evidence that sharedness of knowledge across particular positions in the

team was most important for performance adaptability. Future research might investigate the specific characteristics of roles or positions that enhance or decrease the effects of particular forms of sharedness of knowledge on team performance.

An important theoretical finding was that outcomes of training can have multiple orientations. For example, declarative knowledge can refer to individual positional knowledge or knowledge about team relationships and processes. Similarly, feelings of affect can be oriented toward the self or toward the team as a whole. These different training outcomes all have unique impacts on team adaptability and effectiveness, but these forms of knowledge, affect, and skill all reside within the individual members. It is the sharedness of knowledge, affect, and skill that creates the “teamness” we often see, but it is the individual self-regulatory processes of the members functioning in synchrony that create the sharedness.

Self-regulation in teams. Various studies suggest that self-regulatory processes have strong influences on skill acquisition and training outcomes at the individual level (Etalapelto, 1993; Kanfer & Ackerman, 1989; Kozlowski et al., 1995; Phillips & Gully, in press; Smith et al., 1995). These studies have found that self-regulatory variables are crucial for the effective development of knowledge, elaboration of cognitive structures, acquisition of new skills, and performance on complex tasks (Ford et al., 1995; Kanfer & Ackerman, 1989; Kozlowski et al., 1995). Similarly, according to Kanfer and Ackerman (1989) task performance can be determined by individual differences in attentional resource capability, task demands on attentional resources, and the self-regulatory processes by which people allocate attentional effort across activities (Kanfer, 1990).

Given the limited research on training effects on individuals within team contexts, one of the purposes of the current study was to draw on research on learning and training outcomes at the individual level and use these findings to build a preliminary model of key processes leading to the acquisition of team knowledge and skills. There have been few studies which have endeavored to understand how components of the regulatory system influence teams. However, in those rare cases where such research has been conducted on teams, the entire level of focus has shifted to the team (e.g., Prussia & Kinicki, 1996). The findings in the current study are the first to explicitly demonstrate the impact of individual self-regulatory processes on skill acquisition and performance adaptability in a team environment.

It was found that individual self-regulatory processes involving goals, efficacy perceptions, and feedback had a strong impact on training outcomes and team adaptability. Additionally, consistent with portions of the Kanfer and Ackerman (1989) framework, it was found that cognitive ability had a variety of impacts on self-regulatory processes, training outcomes, and performance adaptability. These findings suggest that ability must be included in future models of regulatory processes within team contexts. Additionally, it perhaps would be fruitful to further explore self-regulatory processes within members of teams to understand how experience and training design factors translate into long-term team success.

Few studies have been done on group or team goal-setting effects (Austin & Bobko, 1985; O'Leary et al., 1994; Smith et al., 1990). Although more recent research has begun to examine this issue, most studies have employed assigned rather than self-set goals. A limited number of studies have attempted to investigate the interplay between the

influences of INDGLS and TMGLS on individuals in a collective environment. Little is known about the determinants of self-set goals in a collective context. Consistent with the conceptual model, it was found that efficacy perceptions had a strong impact on goal-setting throughout training. This was true even after controlling for previous goal levels.

Previous research on goals in collective environments also typically involves either the individual or team level. Less is known about how the focal level of goals influence activities and learning of individuals in collective environments. It was found that both INDGLS and TMGLS were related to a variety of training outcomes, including team adaptability. However, the effects of each type of goal were generally indistinguishable from the other.

Although emerging research suggests the level of a goal may have strong effects on collective performance (Crown & Rosse, 1995; Matsui et al., 1987; Mitchell & Silver, 1990; Saavedra et al., 1993), the current study was unable to distinguish their effects. There are two possible reasons for this finding. First, previous studies have typically manipulated assignment of goals rather than trying to investigate effects of self-set goals. Thus, previous findings may only hold for assigned goals. Second, the current task was very high in interdependence. It is likely that a variety of task characteristics may moderate the influence of self-set goals on team-related outcomes, including task interdependence. Retrospectively, it makes sense that when performance on a task requires the coordinated actions of all members, one's self-set INDGLS would become intertwined with self-set TMGLS. It is hard to imagine high levels of one without high levels of the other.

It is also possible that the relationship between individual self-set goals and team self-set goals can be altered by demands of the task. For example, previous research on the

impact of assigned goals in collective contexts suggests the impact of goals on task performance is due to both goal level and task characteristics (Crown, 1993; Crown & Rosse, 1995). For tasks requiring greater amounts of interdependence, TMGLS lead to higher performance than INDGLS (Saavedra et al., 1993). Similarly, it is possible that individual self-set goals and team self-set goals would become more separable on tasks requiring lower levels of member interaction (lower levels of task interdependence). Future research might investigate the different task conditions under which effects of different types of self-set goals would impact training outcomes and performance adaptability in team contexts.

Numerous studies have demonstrated the impact of SEFF on self-regulatory processes and training outcomes in individual contexts. Individuals higher in SEFF set more challenging goals and remain more committed to them over time (Locke et al., 1984; Locke & Latham, 1990; Wood et al., 1990). Similarly, individuals higher in SEFF are more likely to develop, transfer, and apply skills during and after training. For example, SEFF has been related to acquisition of computer software, bowling, and interpersonal skills (Gist et al., 1989; Martocchio & Webster, 1992; Gist et al., 1991; Mathieu et al., 1993). Additionally, SEFF has been related to the transfer of skills after training (Ford et al., 1992; Kozlowski et al., 1995; Smith et al., 1995). However, almost all of the research attention on efficacy has focused on SEFF, and very little research exists on the influence of team-efficacy on learning and performance in collective environments.

A number of researchers have theorized that team-efficacy and related constructs may be important determinants of collective performance (Bandura, 1982, 1986; Cannon-Bowers et al., 1995; Gist & Mitchell, 1992; Kozlowski, Gully, McHugh, et al., 1996;

Lindsley et al., 1995). As noted by Bandura (1982, p. 143), "perceived collective efficacy will influence what people choose to do as a group, how much effort they put into it, and their staying power when group efforts fail to produce results." Consistent with Bandura's statement, Prussia & Kinicki (1996) found collective efficacy was related to group goals and performance.

The empirical work on team-efficacy and other related constructs is emerging (Cannon-Bowers et al., 1995; Prussia & Kinicki, 1996). Initial findings suggest that perceptions of efficacy and other related constructs have important influences on collective activities (Campion et al., 1993; Campion et al., 1996; Prussia & Kinicki, 1996). However, to date no studies have investigated the effects of collectively-oriented efficacy perceptions on the acquisition and application of trained skills in team environments. The current study demonstrates the unique impact of PTEFF on performance adaptability and the acquisition of knowledge and skills. Also, consistent with Riggs and Knight (1994), findings demonstrated that PTEFF was positively related to satisfaction.

The findings obtained in the study extend previous knowledge regarding efficacy perceptions in several important ways. First, they demonstrate that PTEFF had an influence on cognitive and motivational processes, including goal-setting, cognition, and learning. In some cases, these effects were obtained after controlling for both ability and SEFF. Extending the findings by Riggs and Knight (1994), efficacy was found to impact other affective variables like cohesion. The current study also demonstrates that SEFF and PTEFF become increasingly linked over time.

Another contribution of the current study is to demonstrate that feedback had influences on skill acquisition during training and performance adaptability after training.

Ilgén and Moore (1987) found feedback on quality or quantity affected performance on both dimensions. People tended to match their attention and behaviors to the dimensions of performance feedback provided or available. Similarly, it was found that team feedback had a significant positive influence on skill acquisition and adaptability on an interdependent task. This effect most likely occurred through motivational impacts because learning opportunities were equated across conditions. Consistent with Kozlowski, Gully, McHugh et al. (1996) one of the key characteristics of feedback that influenced how members interpreted and responded to feedback during team training was its level of focus. There was also weak evidence that individual feedback had a negative effect on skill acquisition and performance. Thus, the findings support the contention that one of the most important issues regarding feedback concerns the appropriate aggregation level presented to group or team members (Barr & Conlon, 1994; Jentsch, Navarro, Braun, & Bowers, 1994; Nadler, 1979; Tindale, Kulik, & Scott, 1991). Findings are consistent with the notion that feedback must match task demands to be effective (Kozlowski, Gully, McHugh et al., 1996; Nadler, 1979; Salas & Cannon-Bowers, 1997).

In sum, it appears that self-regulatory variables like efficacy, goals, and feedback all have important implications for learning, skill acquisition, and performance in team contexts. The focal level of each potentially has differential effects on outcomes of training in collective contexts.

Team training. The current study did not explicitly evaluate a number of potentially useful design factors which could impact the self-regulatory processes of individuals in a team training context. For example, previous studies have demonstrated the importance of self-regulation in a learner controlled environment (Smith et al., 1995), and the impact of

mastery goals and advanced organizers on learning and adaptability of training (Kozlowski et al., 1995). Given the support for regulatory processes obtained in the current study, future research might investigate the differential effects of different training design factors on team training outcomes. These design factors might include, but are not limited to, mastery-oriented training, guided discovery, error-based training, and learner control training (Smith, Ford, & Kozlowski, 1997). These factors were highlighted because they are likely to influence the self-regulatory processes of trainees.

Ford et al. (1992) found opportunities to perform trained tasks on the job had an effect on transfer of training. Similar issues might be considered in team training contexts. For example, task demands and workflows are not always constant within teams, and different members might have differential opportunities to practice and perform new skills. Thus, a potentially important design factor for team training that could influence self-regulatory processes is the opportunity to perform both individual position skills and team related skills during and after training.

Individual differences. The findings of the study have a number of implications for the role of individual differences in team training contexts. First, cognitive ability was related to a number of self-regulatory variables, training outcomes, and performance adaptability. These findings are consistent with those obtained for individual skill acquisition (Kanfer & Ackerman, 1989; Kozlowski et al., 1995; Phillips & Gully, in press), but they demonstrate impacts on collective knowledge outcomes and performance. Future studies should more carefully consider the role of ability in understanding team processes, learning and performance. Additionally, although the impact of cognitive ability level was considered in this study, future studies should consider the effect of dispersion in ability

across members within a team. Previous research has demonstrated that the dispersion of ability can have effects on team performance (Tziner & Eden, 1985).

Additionally, given the pervasive effect of self-regulatory variables on team training outcomes and adaptability, it is important to consider other individual difference variables which might impact self-regulatory processes. Mastery and performance goal orientation is an important individual difference variable that can affect the goal-setting process and efficacy of individuals during training (Button, Mathieu, & Zajac, 1996; Kozlowski et al., 1995; Phillips & Gully, in press). Future studies should consider evaluating the effects of goal orientation on goals, efficacy, and team training outcomes.

Individualism versus collectivism (Earley, 1993; Wagner, 1995) also seems a likely individual difference variable to influence the self-regulatory process of team members. Members who are individualistic are likely to set different goals and respond to feedback differently than members of teams who are collectivistic. Additionally, the impact of individual and team training variables on efficacy may vary according to the degree of individual/collective orientation of team members.

Finally, the Big Five taxonomy of personality (e.g., Barrick & Mount, 1993) might prove useful for understanding determinants of individual and team self-setting of goals, efficacy perceptions, and training outcomes. Future studies should consider evaluating the effects of the Big Five characteristics on the self-regulatory processes of team members in training environments.

Applied Implications

There are a variety of practical implications that can be inferred from the findings. It was noted at the beginning of the study that there are few empirically tested theories of

team performance (McIntyre & Salas, 1995; Morgan & Lassiter, 1992; Swezey & Salas, 1992; Tannenbaum & Yukl, 1992). Furthermore, several researchers have noted that little exists to guide human resource practitioners who must design team training systems, and empirically based prescriptions or guidelines are virtually nonexistent for team training (Cannon-Bowers et al., 1995). The findings of this study begin to address this problem by providing a theory of team training which obtained research support on a number of dimensions.

Team training design. As illustrated in the conceptual model, the design of team training must impact the self-regulatory processes of individual members. Additionally, outcomes of training for team members must include team-oriented outcomes as well as individually-oriented outcomes. For example, it is not enough that members receive training on skills which create individual task proficiency; members must receive training on skills which are relevant to team outcomes. Such skills may include communication, coordination, and cooperation (Cannon-Bowers et al., 1995). Thus, training must be designed to provide opportunities to practice and develop both individual and team knowledge and skills.

A second implication of the findings is that training systems must be designed to develop positive self- and team-efficacy. Antecedents of efficacy like vicarious observation, verbal persuasion, and positive feedback could be provided to ensure that positive attitudes and affect are systematically built during the training process. Most importantly, early training experiences should be designed to provide opportunities for both individual and team success. This means that simply throwing a team together to train under adverse circumstances may not be the best strategy for developing performance

adaptability. Training experiences should be carefully built to move team members along a continuum from the development of individual proficiency and SEFF to team proficiency and TEFF. The findings of this study provide support for the theoretical model and guidelines proposed by Kozlowski, Gully, Salas, & Cannon-Bowers (1996).

A final implication is that training experiences must be designed to provide opportunities to explicitly evaluate and discuss role expectations, team strategy, and position responsibilities. It was demonstrated that knowledge of position requirements and sharedness of important task concepts was related to team adaptability. Opportunities to discuss and evaluate role, strategy, and position issues should facilitate the development of effective and shared knowledge structures among team members.

Effective leadership. Current leadership models are underdeveloped for practical application to team environments. The findings of the study corroborate theoretical models of leadership designed specifically for team environments (Kozlowski, Gully, McHugh et al., 1996; Kozlowski, Gully, Salas, et al., 1996). Specifically, it appears that effective team leaders might focus on the development of shared positive affect and attitudes early during team development to ensure the self-regulatory processes of all members are linked and oriented toward the team. As team members interact, leaders may provide different levels of feedback, depending on the timing of team development. However, it is important for leaders to provide team oriented feedback whenever possible.

Effective leaders must work to ensure team members are motivated to self-set high levels of goals. This can occur through the development of positive learning experiences that develop strong perceptions of efficacy. It is also important that leaders are sensitive to the potential impacts of self-regulatory variables on the smooth functioning of the team.

Appraisal and evaluation. The findings also have implications for team appraisal and training evaluation. It is important to consider a variety of training outcomes at different levels when evaluating the effectiveness of team training. This is consistent with the framework provided by Ostroff and Ford (1989). Training designers must be sensitive to the implications of multiple levels of analysis when performing needs analysis. They should also develop evaluation systems according to the needs analysis, with special attention to the implications of multilevel outcomes of training. Ostroff and Ford (1989) suggest it is important to identify the levels of analysis relevant to a particular needs assessment. A needs assessment of training for highly interdependent team members might include individual and team skills, knowledge, and positive affect for effective task performance. Similarly, evaluation of individuals within teams on these dimensions could identify person level needs and strengths.

Results of the study are consistent with Shea and Guzzo's (1987b) model of team appraisal and reward systems. They suggested that three primary variables influenced the effectiveness of human resource management systems for teams. These variables include task interdependence, outcome interdependence, and group potency. Task interdependence refers to patterns of task flow between and among team members. Outcome interdependence refers to the degree to which outcomes are contingent on the performance of the team as a unit. Potency is a variable similar to team-efficacy. Shea and Guzzo suggest when task interdependence is high that outcome interdependence should also be high. The influences of team feedback in this study indirectly support their framework. The task employed in the study was high in interdependence, so high outcome interdependence was warranted. Additionally, they suggest that potency must be high in

order for teams to perform effectively. The findings also support this position. Thus, HR practitioners who are attempting to train teams or implement team-based systems must be sensitive to the degree of task interdependence and the nature of the appraisal processes employed. For teams high in interdependence it may be beneficial to provide interdependent appraisals and outcomes, and it is important to provide enabling conditions like resource availability to ensure positive perceptions of efficacy are fostered.

Limitations and Future Directions

There are several potential limitations of the current study that provide opportunities for future research. First, the sample was a group of college students performing a task in a lab environment, and it is not clear whether findings will generalize to field contexts. Generalizability issues regarding findings involving this sample and research design are minimized because the fidelity of the study in relation to field settings is high (Ilgen, 1986). The purpose of the study was to investigate early learning and skill acquisition in a team context, which can occur just as well within the laboratory as it can in a field setting. Similar processes and outcomes are likely to occur in both the field and the laboratory, increasing the likelihood of generalizability to field contexts (Driskell & Salas, 1992; Ilgen, 1986). The task was important to participants, and they were engaged and motivated to do well on the task. Rewards were offered, and the task had a high degree of intrinsic appeal. On multiple occasions members would yell in frustration or “high five” each other in exhilaration. Thus, although the importance of team tasks in real organizations could not be fully replicated, there was strong evidence that participants were highly involved in the task. These factors suggest the findings of the study are more likely to be generalizable. Although a number of threats to generalizability have been

addressed, it still remains to be seen whether findings in the current study will generalize across samples and settings. Future research should attempt to validate all or part of the model presented using samples obtained from teams in organizations.

Second, the effects of climate and contextual variables were not included. This was true by design as the initial test of the hypotheses had to occur within a tightly controlled setting for increased ability to infer causality. However, it is likely that various organizational climate and contextual variables would have an impact on self-regulatory processes and team training outcomes. These variables could include supervisory support, leader-member exchange relationships, reward systems, and climate to support application of new skills. Future studies should attempt to identify the specific organizational variables important to team training outcomes and evaluate their impact upon individual learning, affect, and behavior.

Finally, although the study took place during five hours over two days, in reality, this time frame is relatively short compared to the longevity of actual teams in organizations. This was not particularly problematic as the purpose of the current study was to investigate self-regulatory effects on early skill acquisition of team members. However, it would be important to conduct studies on team training for teams that have a longer time horizon. It is possible that the impacts of variables obtained in the current study would be different over longer timeframes.

In sum, the current study has proposed and shown that multiple individual and team training outcomes are important to the performance adaptability of teams. It has also demonstrated that individual self-regulatory processes have an impact on learning and performance during training, which in turn, influences performance adaptability. An

important contribution of this study to research on team training is that team-oriented factors have effects which are separate from individually-oriented factors. Another important finding is that efficacy, goals, and feedback have effects on training and performance adaptability, even after controlling for ability. Results of this study should stimulate future research in the areas of team training design and regulatory processes in teams, which will hopefully improve our ability to properly design and administer training to teams performing a variety of difficult tasks. Even small gains in this effort may result in significant impacts on team performance effectiveness and a reduction in the likelihood of team-related errors in circumstances which are crucial to public safety and the lives of the team members.

APPENDICES

APPENDIX A

Appendix A

Power Analysis

Power of Previous Research

The following is a power analysis for a two group ANOVA using typical sample sizes involved in group or team research (see Freeberg & Rock, 1987; Gully, Whitney, & Devine, 1995). Assuming an alpha of .05 and a sample size of 40, the following are the estimated power values for small, medium, and large effect sizes, respectively (Cohen, 1988).

Small effect size ($f = .10$)	Power = .14
Medium effect size ($f = .25$)	Power = .61
Large effect size ($f = .40$)	Power = .95

Estimated Required Sample Size

In order to calculate the sample size required to maintain a power of .80, one must determine what will be the effect size. Guzzo, Jette, and Katzell (1985) obtained a d of .35 for the influence of feedback/appraisal on performance in a meta-analysis of intervention programs. A d of .35 is considered about moderate in effect size (Cohen, 1988). In contrast, Pritchard, Jones, Roth, Stuebing, and Ekeberg (1988) obtained a d of 3.77 for the influence of feedback on performance, which is considered an extremely large effect size. Barr and Conlon (1995) obtained a d of 1.1, which is a very large effect size, for the influence of group feedback sign on intentions to persist.

The effect size for the influence of feedback on learning and performance in the current study is assumed to be moderately large. This assumption is based on the findings of Barr and Conlon (1995), Guzzo et al. (1985), and Pritchard et al. (1988). Additionally, feedback has been shown to affect numerous organizationally relevant outcomes (Fedor, 1991), implying that it has a large effect size in most task domains.

The following format will be used to indicate the results of the power analysis. First, an independent variable and expected effect size for performance is listed using the f statistic from Cohen (1988). The u is then listed, which is equal to the degrees of freedom for the variable in the current study. Next, the α (a) is indicated, which is the probability of type I error. Next, the desired power is indicated; it is set at .80 for all tests. The required N is computed from the cell sample sizes (n_c) which are based on a computation of required sample sizes using the power tables of Cohen (1988, p. 396). The effect size for the influence of feedback on learning is expected to be slightly larger than for performance, but both are expected to be moderate to large in magnitude.

Dependent Variable: Individual or Team Learning ($f = .35$)

<u>Effect</u>	<u>f</u>	<u>u</u>	<u>a</u>	<u>Power</u>	<u>Table</u>	<u>n_c</u>	<u>Req</u> <u>N</u>
Individual	.35	1	.05	.80	33	17	68
Feedback							
Team	.35	1	.05	.80	33	17	68
Feedback							
IFB X TFB	.35	1	.05	.80	33	17	68

Dependent Variable: Individual or Team Performance ($f = .30$)

<u>Effect</u>	<u>f</u>	<u>u</u>	<u>a</u>	<u>Power</u>	<u>Table</u>	<u>n_c</u>	<u>Req</u> <u>N</u>
Individual	.30	1	.05	.80	45	23	92
Feedback							
Team	.30	1	.05	.80	45	23	92
Feedback							
IFB X TFB	.30	1	.05	.80	45	23	92

Conclusions

Approximately 80 to 90 teams will be required to ensure that I will have a power of .80 to detect a moderate to large effect size. This suggests that 22 teams in each cell will be sufficient.

APPENDIX B

Appendix B

Feedback Instructions

Feedback Instructions - Individual and Team Feedback

In the upper right corner, you will see the Team score, labelled TScore. Each correct decision (Type, Class, Intent, Engage) made by members will increase the points for the team. Each incorrect decision will decrease the points for the team. The Type, Class, and Intent decisions must be made and then you or one of your teammates must make the Engagement decision for the team to gain or lose points. **You will not see a score change in TScore, even after the Type, Class, and Intent decisions have been made, until the Engage decision is rendered.** Remember that the Engagement decision WILL affect your Team score, even if it is made by another member. **Use changes in your Team Score to see how well you are working together as a team.**

Also in the upper right of your console, you will see your Individual score, labelled IScore. Each correct decision you make will increase your points. Each incorrect decision you make will decrease your points. You must make the decision for your position, then you or one of your teammates must make the Engage decision for you to gain or lose points. **You will not see a score change in IScore, even after you have made the decision for your position, until the Engagement decision is rendered.** Remember that the Engagement decision WILL NOT affect your Individual score if it is made by another member. **Use changes in your Individual Score to see how well you are performing in your position.**

When a person makes the Engage decision, the person making the Engage decision can press and hold the right mouse button down. Then that person will receive feedback regarding the true characteristics of the contact being processed. **You must share information about the true characteristics of the contact with all of the other team members.** This is very important. So, if you are making the Engage decision, make sure you hold the right mouse button down and then tell your teammates the true nature of the contact. You should state the correct Type, Class, Intent, and Engage decisions for the contact being processed.

Remember, when your decisions about a contact are accurate, TAS will give you points as positive feedback. When the decisions you make about a contact are not accurate, TAS will take points away. You can use this feedback to help you learn about the game and how you are doing.

Feedback Instructions - Team Feedback Only

In the upper right corner, you will see the Team score, labelled TScore. Each correct decision (Type, Class, Intent, Engage) made by members will increase the points for the team. Each incorrect decision will decrease the points for the team. The Type, Class, and Intent decisions must be made and then you or one of your teammates must make the Engagement decision for the team to gain or lose points. **You will not see a score change in TScore, even after the Type, Class, and Intent decisions have been made, until the Engage decision is rendered.** Remember that the Engagement decision WILL affect your Team score, even if it is made by another member. **Use changes in your Team Score to see how well you are working together as a team.**

When a person makes the Engage decision, the person making the Engage decision can press and hold the right mouse button down. Then that person will receive feedback regarding the true characteristics of the contact being processed. **You must share information about the true characteristics of the contact with all of the other team members.** This is very important. So, if you are making the Engage decision, make sure you hold the right mouse button down and then tell your teammates the true nature of the contact. You should state the correct Type, Class, Intent, and Engage decisions for the contact being processed.

Remember, when your decisions about a contact are accurate, TAS will give you points as positive feedback. When the decisions you make about a contact are not accurate, TAS will take points away. You can use this feedback to help you learn about the game and how you are doing.

Feedback Instructions - Individual Feedback Only

In the upper right of your console, you will see your Individual score, labelled IScore. Each correct decision you make will increase your points. Each incorrect decision you make will decrease your points. You must make the decision for your position, then you or one of your teammates must make the Engage decision for you to gain or lose points. **You will not see a score change in IScore, even after you have made the decision for your position, until the Engagement decision is rendered.** Remember that the Engagement decision WILL NOT affect your Individual score if it is made by another member. **Use changes in your Individual Score to see how well you are performing in your position.**

When a person makes the Engage decision, the person making the Engage decision can press and hold the right mouse button down. Then that person will receive feedback regarding the true characteristics of the contact being processed. **You must share information about the true characteristics of the contact with all of the other team members.** This is very important. So, if you are making the Engage decision, make sure

you hold the right mouse button down and then tell your teammates the true nature of the contact. You should state the correct Type, Class, Intent, and Engage decisions for the contact being processed.

Remember, when your decisions about a contact are accurate, TAS will give you points as positive feedback. When the decisions you make about a contact are not accurate, TAS will take points away. You can use this feedback to help you learn about the game and how you are doing.

Feedback Instructions - No Feedback

When a person makes the Engage decision, the person making the Engage decision can press and hold the right mouse button down. Then that person will receive feedback regarding the true characteristics of the contact being processed. **You must share information about the true characteristics of the contact with all of the other team members.** This is very important. So, if you are making the Engage decision, make sure you hold the right mouse button down and then tell your teammates the true nature of the contact. You should state the correct Type, Class, Intent, and Engage decisions for the contact being processed.

Remember, when your decisions about a contact are accurate, TAS will give you points. When the decisions you make about a contact are not accurate, TAS will take points away.

APPENDIX C

Appendix C

Consent Form

Subject # _____

Team Training and Decision Making Effectiveness

The study in which you are about to participate investigates your performance of the Tactical Action Simulation (TAS). TAS is a computer simulated, radar tracking task in which you and two teammates will gather information about contacts on your radar screen and decide what action should be taken for those contacts. Your computer screen will be video taped and your communications with other team members during the task will be audio taped. You will also be asked to answer questionnaires to help us understand your task performance. Your participation will help us to understand how to better train people in teams.

In filling out the questionnaires, it is essential that you respond as honestly and accurately as you can. We would also like your permission to receive your ACT/SAT scores and grade point average from Michigan State University. Your signature below and social security number will authorize us to do this. All of the information that you provide will be kept strictly confidential. All material containing your name and other identifying information will be removed and locked in a file after your involvement in this study. The only people who can obtain this information are the researchers who must have access to it. The results of the study will not be reported in any way that would make it possible to identify your responses.

The experiment will consist of two sessions of two and a half hours each, for a total of five hours. In return for your involvement, you will receive an opportunity to win \$15 or \$10 for the performance of your team, \$10 or \$7 for your individual performance, and \$5 for accurately answering questions about the task. You will also receive ten Psychology subject pool credits for completing this study. No possible risks or discomforts are anticipated as a result of this study. At the end of your involvement, you will be given feedback detailing the purpose of this research.

Participation in this study is strictly voluntary. You may terminate your participation in this study at any time for any reason. If you do, an alternative activity requiring comparable time and effort will be made available to you so that you can earn the same amount of subject pool credits. Please inform the researcher of any questions you might have before signing this form. Please print and sign your name below indicating that you have read this consent form and voluntarily agree to participate in this study. Also, please fill in the social security number because it is necessary in order for us to obtain your ACT/SAT scores. If you have concerns about the study, want to know more about the study, or would like to see overall results in the future, you may contact Stanley Gully in the Department of Psychology at 123-4567.

PRINTED NAME: _____ DATE: _____

SIGNATURE: _____ STUDENT NUMBER: _____

SOCIAL SECURITY NUMBER: _____

APPENDIX D

Appendix D

Measurement Scales Included in Study

Demographics (11 items)

Goal orientation (16 items)

Individualism/collectivism (20 items)

Wonderlic, ACT/SAT

Day 1:

T1: Measure of self-efficacy (6 items)

T1: Measure of personal team-efficacy (6 items)

T1: Measure of individual goal setting (3 items)

T1: Measure of team goal setting (3 items)

T1: Measure of individual goal commitment (3 items)

T1: Measure of team goal commitment (3 items)

T2: Measure of self-efficacy (6 items)

T2: Measure of personal team-efficacy (6 items)

T2: Measure of individual goal setting (3 items)

T2: Measure of team goal setting (3 items)

T2: Measure of individual goal commitment (3 items)

T2: Measure of team goal commitment (3 items)

T3: Measure of self-efficacy (6 items)

T3: Measure of personal team-efficacy (6 items)

T3: Individual and team declarative knowledge (28 items)

T3: Individual role clarity (4 items)

T3: Interpositional certainty (4 items)

T3: Satisfaction (individual/team) (7 items)

T3: Task frustration (6 items)

T3: Cohesion (6 items)

Day 2:

T4: Measure of self-efficacy (6 items)

T4: Measure of personal team-efficacy (6 items)

T4: Measure of individual goal setting (3 items)

T4: Measure of team goal setting (3 items)

T4: Measure of individual goal commitment (3 items)

T4: Measure of team goal commitment (3 items)

T5: Measure of self-efficacy (6 items)

T5: Measure of personal team-efficacy (6 items)

T5: Measure of individual goal setting (3 items)

T5: Measure of team goal setting (3 items)

T5: Measure of individual goal commitment (3 items)

T5: Measure of team goal commitment (3 items)

Adapted from Widmeyer, Brawley, & Carron (1985)



1. Our team is united in trying to reach its goals for performance. (TSK)
2. Members of our team would rather be alone than get together socially. (SOC)
3. We all take responsibility for any loss or poor performance by our team. (TSK)
4. Our team would like to spend time together socially. (SOC)
5. Our team members have conflicting aspirations for the team's performance. (TSK)
6. Members of our team will NOT stick together casually outside of this performance environment. (SOC)

Demographic Information

INSTRUCTIONS FOR ANSWERING QUESTIONS ON THE SCANTRON

Please write your last name in the area marked YOUR LAST NAME. Please write in your first name and middle initial in the areas marked YOUR FIRST NAME and MI. Do NOT bubble the letters since we will not be using your name for data, and your responses will be kept anonymous. After filling in your name please answer the following questions by filling in the appropriate bubble, beginning with question number 1.

Demographics

1. What is your sex?
(1) Male (2) Female
2. What is your age?
(1) less than 18 yrs (2) 18-19 yrs (3) 20-21 yrs (4) 22-23 yrs (5) greater than 23 yrs

3. What is your overall grade point average?

(1) 0 to 1.0 (2) 1.1 to 2.0 (3) 2.1 to 3.0 (4) 3.1 to 4.0 (5) > 4.0

4. How often do you play or work in teams?

<-----1-----2-----3-----4-----5----->
 Monthly Weekly Daily
 or less

5. Class standing:

(1) Freshman (2) Sophomore (3) Junior (4) Senior (5) Other

6. Have you ever participated in studies involving TAG, TAS, or Discovery Learning?

(1) Yes (2) No

7. Approximately how often do you use a personal computer?

<-----1-----2-----3-----4-----5----->
 Monthly Weekly Daily
 or less

8. Approximately how often do you play video games?

<-----1-----2-----3-----4-----5----->
 Monthly Weekly Daily
 or less

Approximately how well do you know each of the people you will be working with today?
 (don't rate yourself -- please leave the item for yourself blank)

9. Alpha:

<-----1-----2-----3-----4-----5----->
 Not at Casual Very good
 All Acquaintance Friends

10. Bravo:

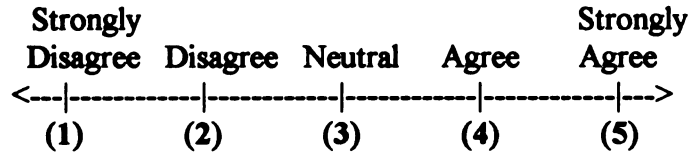
<-----1-----2-----3-----4-----5----->
 Not at Casual Very good
 All Acquaintance Friends

11. Charlie:

<-----1-----2-----3-----4-----5----->
 Not at Casual Very good
 All Acquaintance Friends

Goal Commitment - Individual Goal
Adapted from Hollenbeck, Klein, O'Leary, & Wright (1989)

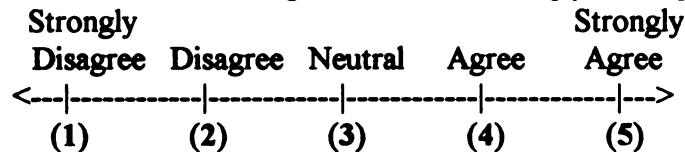
Please answer the following questions as they pertain to the **individual goal** you just set for yourself for the upcoming task session. Use the following scale in determining your responses:



1. It's hard for me to take my individual goal seriously. (IGC1-R)
2. Quite frankly, I don't care whether or not I achieve my individual goal. (IGC2-R)
3. I am strongly committed to pursuing the individual goal for this position. (IGC3)

Goal Commitment - Team Goal
Adapted from Hollenbeck, Klein, O'Leary, & Wright (1989)

Please answer the following questions as they pertain to the **team goal** you just set for the upcoming task session. Use the following scale in determining your responses:

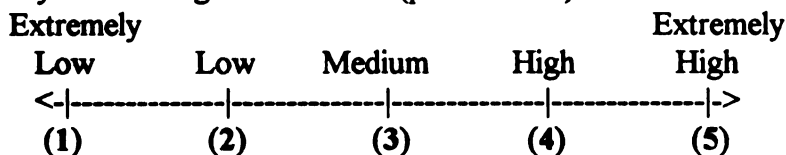


1. It's hard for me to take the team goal seriously. (TGC1-R)
2. Quite frankly, I don't care whether or not we achieve the team goal. (TGC2-R)
3. I am strongly committed to pursuing the team goal. (TGC3)

Goal Setting - Individual Goal

Please set a specific **individual goal** for the upcoming session. What is your **individual goal** for this session?

1. My individual goal is to score _____ points in my position. (your answer should reflect how many points you are aiming for you to score)
2. My individual goal is to score _____ percent of the total points possible in my position. (your answer should not be more than 100%)
3. My individual goal is to score (please circle)



Goal Setting - Team Goal

Please set a specific team goal for the upcoming session. What is your team goal for this session?

1. My goal for the team is to score _____ points for the team as a whole. (your answer should reflect how many points you are aiming for the team to score)
2. My team goal is to score _____ percent of the total points possible for the team. (your answer should not be more than 100%)
3. My team goal is for the team to score (please circle)

Extremely Low Low Medium High Extremely High

<-----|-----|-----|-----|----->

(1) (2) (3) (4) (5)

Individualism-Collectivism Wagner (1995)

Strongly Disagree Disagree Neutral Agree Strongly Agree

<-----|-----|-----|-----|----->

(1) (2) (3) (4) (5)

Factor 1

1. Only those who depend on themselves get ahead in life. (IC1-R)
2. To be superior a person must stand alone. (IC2-R)
3. If you want something done right, you've got to do it yourself. (IC3-R)
4. What happens to me is my own doing. (IC4-R)
5. In the long run, the only person you can count on is yourself. (IC5-R)

Factor 2

6. Winning is everything. (IC6-R)
7. I feel that winning is important in both work and games. (IC7-R)
8. Success is the most important thing in life. (IC8-R)
9. It annoys me when other people perform better than I do. (IC9-R)
10. Doing your best isn't enough; it is important to win. (IC10-R)

Factor 3

11. I prefer working with others in a group rather than working alone. (IC11)
12. Given the choice, I would rather do a job where I can work alone rather than doing a job where I have to work with others in a group. (IC12-R)
13. Working with a group is better than working alone. (IC13)

Factor 4

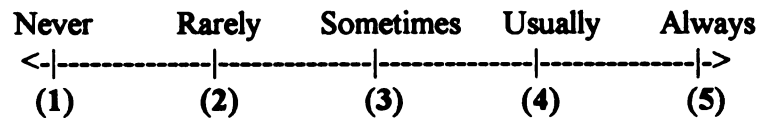
14. People should be made aware that if they are going to be part of a group then they are sometimes going to have to do things they don't want to do. (IC14)
15. People who belong to a group should realize that they're not always going to get what they personally want. (IC15)

16. People in a group should realize that they sometimes are going to have to make sacrifices for the sake of the group as a whole. (IC16)
17. People in a group should be willing to make sacrifices for the sake of the group's well-being. (IC17)

Factor 5

18. A group is more productive when its members do what they want to do rather than what the group wants them to do. (IC18-R)
19. A group is most efficient when its members do what they think is best rather than doing what the group wants them to do. (IC19-R)
20. A group is more productive when its members follow their own interests and concerns. (IC20-R)

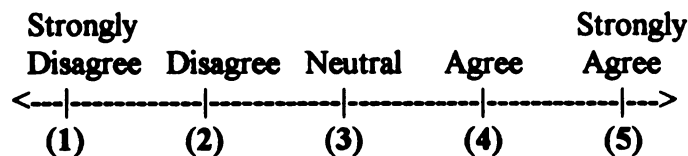
Interpositional Certainty Adapted from Baker (1991)



1. I know what is expected of my teammates in terms of their task duties.
2. My teammates' responsibilities are clearly understood by me.
3. I know what tasks my teammates are responsible for when we perform the task.
4. I have a good idea of what my teammates can do to improve their performance on this task.

Learning and Performance Goal Orientation Button, Mathieu, & Zajac (1996)

This set of questions asks you to describe how you feel about each of the following statements. Please use the scale shown below to make your ratings.



Check to make sure you are beginning on question number XX.

1. I do my best when I'm working on a fairly difficult task. (LEARNG1)
2. When I have difficulty solving a problem, I enjoy trying different approaches to see which one will work. (LEARNG2)
3. I try hard to improve on my past performance. (LEARNG3)
4. The opportunity to do challenging work is important to me. (LEARNG4)

5. The opportunity to extend the range of my abilities is important to me. (LEARNG5)
6. The opportunity to learn new things is important to me. (LEARNG6)
7. I prefer to work on tasks that force me to learn new things. (LEARNG7)
8. When I fail to complete a difficult task, I plan to try harder the next time I work on it. (LEARNG8)

1. The things I enjoy the most are the things I do the best. (PERFG1)
2. I feel smart when I do something without making any mistakes. (PERFG2)
3. I prefer to do things that I can do well rather than things that I do poorly. (PERFG3)
4. I like to be fairly confident that I can successfully perform a task before I attempt it. (PERFG4)
5. I am happiest at work when I perform tasks on which I know that I won't make any errors. (PERFG5)
6. I feel smart when I can do something better than most other people. (PERFG6)
7. The opinions others have about how well I can do certain things are important to me. (PERFG7)
8. I like to work on tasks that I have done well on in the past. (PERFG8)

Pathfinder Instructions

Your goal is to make "relatedness" ratings about actions you and your team members perform in the Tactical Action Simulation (TAS). We want you to think about how strongly or weakly pairs of actions from TAS "go together" or "are connected" in a meaningful way IN YOUR MIND when you perform the TAS simulation.

Pairs of actions will be presented by the computer in random order, so the order of presentation is not important -- whether an action is presented as the first or second item in a pair should not affect your ratings of relatedness. We are only interested in how strong or weak YOU THINK the overall connection is between each pair of aspects.

^

As you make your ratings, bear in mind that the actions can go together in different ways. For example, your ratings should indicate HOW STRONGLY OR WEAKLY you think:

- (1) a particular position relates to taking a particular action (e.g., how much Alpha relates to ID TYPE, or how much Charlie relates to Get Signal Strength) or
- (2) taking one action relates to taking another action (e.g., how much Get Signal Strength relates to Get Communication Time or how much Prioritize Contacts relates to Get Course or Get Speed) or
- (3) making one decision relates to making another decision (e.g., how much ID TYPE relates to ENGAGE).

^

Each pair of actions will be presented on the screen along with a "relatedness" rating scale. Pairs of actions that you think are weakly related should be rated with 1, 2, or 3; moderately related pairs should be rated 4, 5, or 6; and highly related pairs should be rated 7, 8, or 9 by pressing the number on the keyboard -- a bar marker will move directly above

the number you pressed. If you wish to change your response, simply press another number. When you are satisfied with your rating, press the SPACE BAR to enter your response. The next pair of items to be rated will be then be displayed.

^

Because the TAS simulation is complex, there are many pairs of actions to be rated -- please make your ratings carefully. It is very important to us that you think about HOW RELATED THEY SEEM TO YOU based on your experience with TAS.

If at any time you feel like taking a break tell the experimenter you are doing so and leave the machine running. Thanks for helping us with this part of the experiment.

Now the complete list of actions and concepts to be rated will be presented. This is done to give you a general idea of the types of actions you will asked to rate. Thank you again for your help.

^

Pathfinder Cues

ALPHA

ID_TYPE

ENGAGE

Get/Send Course

Get/Send Signal Strength

Get/Send Direction of Origin

Get/Send Response

SCORE

BRAVO

ID_CLASS

Prioritize Contacts

CHARLIE

ID_INTENT

Get/Send Speed

Get/Send Altitude/Depth

Get/Send Maneuvering Pattern

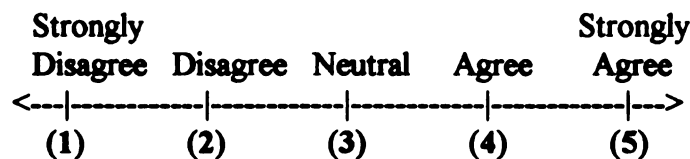
Get/Send Missile Lock

Defensive Perimeter

Personal Team-Efficacy

Adapted from from Ford et al. (1995); Kozlowski et al. (1995);
Phillips & Gully (in press)

This set of questions asks you to describe how you feel about the team's capabilities as a unit to perform TAS. Please use the scale shown below to make your ratings.



1. I believe the team can meet the challenges of the simulation. (PTE1)
2. I am certain that the team can manage the requirements of this task. (PTE2)
3. I believe the team will fare well in this task if the workload is increased. (PTE3)
4. I am confident that the team can cope with the demands of this task if it becomes more complex. (PTE4)
5. I believe the team can develop methods to handle changing aspects of this task. (PTE5)
6. I am certain the team can cope with task components competing for our time. (PTE6)

Pilot Study Questionnaire
Feedback to the Researcher

1. Did the researcher clearly explain everything that was going on with regard to the research project? Please explain. _____

2. Did you ever feel like the researcher was trying to deceive you or manipulate what you were doing on the task? Please explain as clearly as possible. _____

3. What do you think the research you just took part in was all about? _____

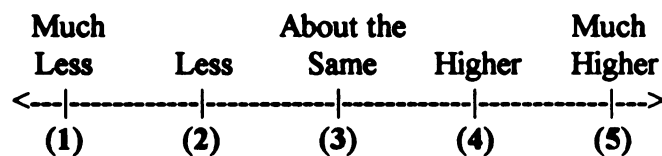
4. If you noted any problems with the questionnaires in this experiment, please describe them: _____

5. If you can think of anything the person doing this research can do to improve the instructions given to participants, please list them: _____

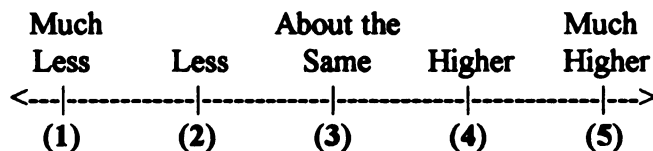
6. Do you have any comments or suggestions with regard to this research effort? (You can continue on the back of this sheet). _____

Please rate the final task you performed on the following dimensions.

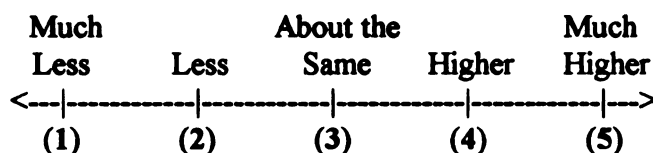
1. As compared to the training trials, how do you feel about the workload on the final trial? The workload of the final trial was _____ than the training trials.



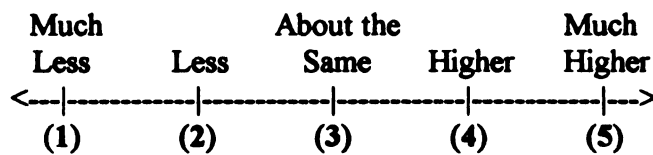
2. As compared to the training trials, how do you feel about the complexity on the final trial? The task complexity of the final trial was _____ than the training trials.



3. As compared to the training trials, how do you feel about the difficulty on the final trial? The difficulty of the final trial was _____ than the training trials.



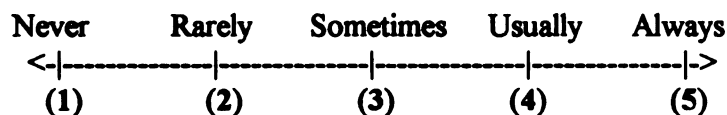
4. As compared to the training trials, how do you feel about the importance of the final trial? The importance of the final trial was _____ than the training trials.



Thank you for your time and attention!

Role Clarity

Adapted from Rizzo, House, & Lirtzman (1970)

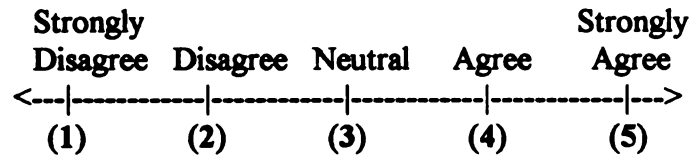


1. I know what is expected of me in terms of my task duties.
2. My individual role responsibilities are clearly understood by me.
3. I know what tasks I am responsible for when we perform the task.
4. I have a good idea of what I can do to improve my individual performance on this task.

Self-Efficacy

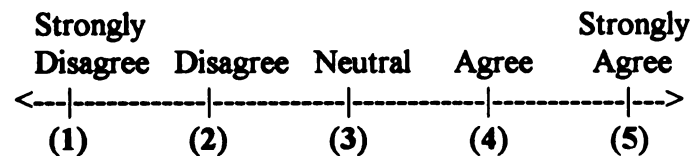
**Adapted from Ford et al. (1995); Kozlowski et al. (1995);
Phillips & Gully (in press)**

This set of questions asks you to describe how you feel about your capabilities to perform TAS. Please use the scale shown below to make your ratings.



1. I can meet the challenges of my role in this simulation. (SE1)
2. I am certain that I can manage the requirements of my position for this task. (SE2)
3. I believe I will fare well in this task as an individual if the workload is increased. (SE3)
4. I am confident that I can cope with the demands of my role if the simulation becomes more complex. (SE4)
5. I believe I can develop methods to handle changing aspects of this task and my role. (SE5)
6. I am certain I can cope with task components competing for my time. (SE6)

**Task Frustration - Adapted from
Peters & O'Connor (1980); Chen & Spector (1991)**



Individual

1. Trying to get this task done was rarely frustrating for me.
2. I was frustrated when trying to perform this task.
3. Overall, I experienced very little frustration on this task.

Team

4. Trying to get this task done was rarely frustrating for the team as a whole.
5. The team was frustrated when trying to perform this task.
6. Overall, the team experienced very little frustration on this task.

Task Knowledge

Knowledge Test - Items Common to Alpha, Bravo, and Charlie

Please use the Scantron sheet to answer the following questions. Bubble in the correct letter for each question, making sure that the question numbers match.

4. Which of the following contacts is the most threatening?

a. Air-Military-Peaceful	*b. Sub-Military-Hostile
c. Surface-Civilian-Hostile	d. Surface-Military-Hostile
e. Sub-Military-Peaceful	

5. Which of the following contacts should be Warned in the ENGAGE decision?
- a. Air-Military-Peaceful; Sub-Military-Peaceful
 - b. Sub-Military-Peaceful; Surface-Military-Hostile
 - *c. Surface-Military-Peaceful; Air-Civilian-Hostile
 - d. Surface-Military-Hostile; Sub-Military-Hostile
 - e. Sub-Military-Hostile; Surface-Civilian-Hostile
6. Which of the following is true regarding the Engage decision?
- a. The threat of a contact is determined solely by its Intent
 - b. Air contacts are less threatening than Sub or Surface contacts
 - c. Civilian contacts are more threatening than Military contacts
 - d. Hostile contacts are less threatening than Peaceful contacts
 - *e. The threat of a contact is determined by its Type, Class, and Intent
9. Which of the following are the three decisions that need to be made by each position?
- *a. Intent-Charlie, Class-Bravo, Type-Alpha
 - b. Class-Alpha, Type-Bravo, Intent-Charlie
 - c. Type-Charlie, Class-Alpha, Intent-Bravo
 - d. Class-Bravo, Intent-Alpha, Type-Charlie
12. If three contacts are outside your inner defensive perimeter, which of the following should you do to prioritize the contacts?
- *a. Check the Course and Speed of the contact
 - b. Process the contact with the most threatening profile
 - c. Identify the Intent of the contact
 - d. Process the contact which is furthest away with the highest Speed
 - e. It makes no difference in what order you process the contacts
13. Which of the following contacts should be processed first?
- a. Bearing 90 degrees, Range 32 nm, Speed 500 Knots, Course 180 degrees
 - *b. Bearing 270 degrees, Range 14 nm, Speed 127 Knots, Course 90 degrees
 - c. Bearing 0 degrees, Range 11, Speed 25 Knots, Course 0 degrees
 - d. Bearing 180 degrees, Range 21 nm, Speed 210 Knots, Course 270 degrees
16. Which of the following is true about team communication?
- a. Communication can be confusing so people should talk a lot and be very explicit about what is being said
 - *b. Communication takes a lot of time and effort, so shorter messages are better to facilitate processing of contacts
 - c. Consistency in communication practices is not important
 - d. One should never use shortened terms when communicating with others
 - e. Communication about each other's performance is not important
17. Which of the following is true about team coordination?
- a. You should work only on your task as fast as you can
 - b. You shouldn't tell others when they are making mistakes

- c. You don't need to anticipate the needs of others
- d. The order in which tasks are performed isn't important
- *e. Everyone should know each other's roles on the team

18. Which of the following is true about team cooperation?

- a. It is not important to effective team performance
- b. If you are overloaded, you should not ask for help from other team members
- c. If someone asks for information, you should get to it when you are done with your other tasks
- *d. You should help other members out whenever you can or when they ask for help
- e. You should loudly criticize others if they fail to help you

19. Which of the following is a poor form of mutual performance monitoring?

- a. Tell your teammates in a noncritical manner when you notice an error or mistake
- b. Watch and listen to your teammates as they perform their tasks, even if you are not responsible for a particular task
- *c. The key is to tell people when they've made a mistake, and then let them figure out how to improve on their own
- d. Ask others for input on how you can improve in the performance of your role
- e. You should provide error detection and correction in a nonthreatening manner

20. Which of the following is true about team morale?

- a. It has almost no influence on team performance
- b. Members should rarely encourage each other, or you can overdo it
- *c. It requires members to make positive comments about the team
- d. Members should look at mistakes and errors as failures of the team

21. The following symbol best represents which type of contact? U

- a. Air-Military
- b. Sub-Civilian
- c. Air-Civilian
- d. Surface-Military
- *e. Surface-Civilian

22. Which of the following colors best represents a Military contact?

- a. White
- b. Yellow
- c. Blue
- *d. Red
- e. Green

23. If contacts are near your defensive perimeter, which of the following three pieces of information do you require to prioritize the processing of contacts?

- a. ID_TYPE, ID_CLASS, ID_INTENT
- *b. Bearing, Course, Speed
- c. Maneuvering Patter, Speed, ID_INTENT
- d. ID_INTENT, Course, Speed
- e. ID_CLASS, Course, Speed

24. Which of the following is the correct sequence of decision making?

- a. ID_TYPE, ID_CLASS, ENGAGE, ID_INTENT
- b. ID_CLASS, ID_TYPE, ID_INTENT, ENGAGE
- c. ID_CLASS, ID_INTENT, ID_TYPE, ENGAGE
- d. ENGAGE, ID_TYPE, ID_CLASS, ID_INTENT

***e. ID_TYPE, ID_CLASS, ID_INTENT, ENGAGE**

25. Which of the following is true about team strategy?

- *a. It should openly be discussed.**
- b. It should rarely be discussed openly.**
- c. It has no influence on team performance.**
- d. It has no effect on the roles of team members.**

26. Who in your team is primarily responsible for Engaging contacts?

- a. Alpha**
- b. Bravo**
- c. Charlie**
- d. All of us**

27. Who in your team is primarily responsible for prioritizing contacts?

- a. Alpha**
- b. Bravo**
- c. Charlie**
- d. All of us**
- e. None of us**

28. Who in your team is the team leader?

- a. Alpha**
- b. Bravo**
- c. Charlie**
- d. All of us**
- e. None of us**

Knowledge Test - Items Unique to Alpha

1. Which of the following is true regarding the Type decision?

- a. Climb/Dive_Rate of -45 m indicates Air**
- b. Altitude/Depth of -22 m indicates Surface**
- c. Signal_Strength of Medium indicates Sub**
- d. Climb/Dive_Rate of 1 m indicates Surface**
- *e. Communication_Time of 38 s indicates Air**

2. Which of the following should be identified as Type=Air?

- a. Climb/Dive_Rate= -22 m; Altitude/Depth= -10 m; Signal_Strength=Medium; Communication_Time=92 s**
- *b. Communication_Time=32 s; Altitude/Depth=15 m; Climb/Dive_Rate= -49 m; Signal_Strength=Medium**
- c. Signal_Strength=High; Altitude/Depth=145 m; Communication_Time=63 s; Climb/Dive_Rate=0 m**
- d. Altitude/Depth=0 m; Signal_Strength=High; Climb/Dive_Rate=232 m; Communication_Time=44 s**
- e. Signal_Strength=Low; Altitude/Depth=19 m; Communication_Time=104 s; Climb/Dive_Rate= -12 m**

**3. Which of the following actions should you take if you know the following information:
Missile_Lock is Locked; Communication_Time = 43 s; Direction_of_Origin is Black River; Climb/Dive_Rate = 23 m?**

- a. Choose ENGAGE = Shoot**
- b. Choose ID_TYPE = Air**
- *c. Get Altitude/Depth from Bravo**
- d. Get Countermeasures from Charlie**
- e. Choose ID_CLASS = Military**

7. Which of the following pieces of information do you need from Charlie?

- a. Climb/Dive_Rate
- b. Course
- c. Altitude/Depth
- *d. Signal_Strength
- e. Direction_of_Origin

8. Which of the following pieces of information do you need from Bravo?

- a. Communication_Time
- b. Speed
- *c. Altitude/Depth
- d. Signal_Strength
- e. Missile_Lock

10. Which of the following is information you need to send to Bravo?

- *a. Direction_of_Origin
- b. Missile_Lock
- c. Communication_Time
- d. Climb/Dive_Rate

11. Which of the following is information you need to send to Charlie?

- a. Direction_of_Origin
- b. Communication_Time
- *c. Missile_Lock
- d. Climb/Dive_Rate

14. Which of the following is a true statement?

- *a. Bravo needs Direction of Origin from Alpha and Maneuvering Pattern from Charlie
- b. Charlie needs Response from Alpha and Signal Strength from Bravo
- c. Alpha needs Course from Bravo and Speed from Charlie
- d. Bravo needs Speed from Alpha and Course from Charlie
- e. Alpha needs Signal Strength from Bravo and Altitude/Depth from Charlie

15. Which of the following is an example of communication that is the most effective?

- a. Alpha to Team. Popup contact number 17 near defensive perimeter at 180 degrees, course 0 degrees, moderate speed. Process first.
- b. Alpha to Team. I just saw a popup contact appear near the defensive perimeter. It's bearing is about 180 and it's course is 0 degrees. That means it is moving toward us so I think we should probably engage it as soon as possible.
- *c. Alpha Team. C17. Popup near DP bearing 180, course 0, moderate speed. Do first.
- d. This is Alpha. Everyone, there is a popup contact I just saw pop up near the defensive perimeter at about 180 degrees that is moving at moderate speed. It's course is 0 degrees, so it is headed toward our ship and I think we should process it first.

Knowledge Test - Items Unique to Bravo

1. Which of the following is true regarding the Class decision?

- a. Initial_Range of 132 nm indicates Civilian
- b. Maneuvering_Pattern of Echo indicates Military
- c. Direction_of_Origin of Red Sea indicates Unknown
- d. Intelligence of Platform indicates Civilian
- *e. Initial_Range of 18 nm indicates Civilian

2. Which of the following should be identified as Class=Military?
 - a. Initial_Range=18.9 nm; Maneuvering_Pattern =Code Foxtrot; Direction_of_Origin=Red Sea; Intelligence=Stage
 - *b. Intelligence=Platform; Maneuvering_Pattern=Code Delta; Initial_Range=16.3 nm; Direction_of_Origin=Red Sea
 - c. Direction_of_Origin=Black River; Maneuvering_Pattern=Code Echo; Initial_Range=47 nm; Intelligence=Stage
 - d. Maneuvering_Pattern=Foxtrot; Direction_of_Origin=Blue Lagoon; Initial_Range=232 nm; Intelligence=Private
 - e. Direction_of_Origin=Blue Lagoon; Maneuvering_Pattern=Code Delta; Intelligence=Private; Initial_Range=12 nm

3. Which of the following actions should you take if you know the following information: Altitude_Depth is 142 m; Intelligence = Platform; Response is No Response; Initial_Range = 14.3 nm?
 - a. Choose ENGAGE = Shoot
 - b. Choose ID_CLASS = Military
 - *c. Get Maneuvering_Pattern from Charlie
 - d. Get Missile_Lock from Alpha
 - e. Choose ID_TYPE = Air

7. Which of the following pieces of information do you need from Charlie?
 - a. Initial_Range
 - b. Course
 - c. Direction_of_Origin
 - *d. Maneuvering_Pattern
 - e. Altitude_Depth

8. Which of the following pieces of information do you need from Alpha?
 - a. Intelligence
 - b. Speed
 - *c. Direction_of_Origin
 - d. Maneuvering_Pattern
 - e. Response

10. Which of the following is information you need to send to Charlie?
 - *a. Response
 - b. Altitude/Depth
 - c. Intelligence
 - d. Initial_Range

11. Which of the following is information you need to send to Alpha?
 - a. Response
 - b. Intelligence
 - *c. Altitude/Depth
 - d. Initial_Range

14. Which of the following is a true statement?
 - *a. Charlie needs Missile_Lock from Alpha and Response from Bravo
 - b. Charlie needs Response from Alpha and Signal Strength from Bravo
 - c. Alpha needs Course from Bravo and Speed from Charlie
 - d. Bravo needs Speed from Alpha and Course from Charlie
 - e. Alpha needs Signal Strength from Bravo and Altitude/Depth from Charlie

15. Which of the following is an example of communication that is the most effective?

- a. Bravo to Team. Popup contact number 17 near defensive perimeter at 180 degrees, course 0 degrees, moderate speed. Process first.
- b. Bravo to Team. I just saw a popup contact appear near the defensive perimeter. It's bearing is about 180 and it's course is 0 degrees. That means it is moving toward us so I think we should probably engage it as soon as possible.
- *c. Bravo Team. C17. Popup near DP bearing 180, course 0, moderate speed. Do first.
- d. This is Bravo. Everyone, there is a popup contact I just saw pop up near the defensive perimeter at about 180 degrees that is moving at moderate speed. It's course is 0 degrees, so it is headed toward our ship and I think we should process it first.

Knowledge Test - Items Unique to Charlie

Please use the Scantron sheet to answer the following questions. Bubble in the correct letter for each question, making sure that the question numbers match.

1. Which of the following is true regarding the Intent decision?
 - a. Countermeasures of Sporadic indicates Hostile
 - b. Missile_Lock of Locked indicates Peaceful
 - c. Response of Inaudible indicates Peaceful
 - d. Countermeasures of Jamming indicates Surface
 - *e. Electronic_Warfare of Detected indicates Hostile

2. Which of the following should be identified as Intent=Peaceful?
 - a. Countermeasures=None; Missile_Lock=Locked; Response=Inaudible; Electronic_Warfare=Detected
 - *b. Electronic_Warfare=Detected; Missile_Lock=Clean; Countermeasures=None; Response=Given
 - c. Response=Given; Missile_Lock=Locked; Electronic_Warfare=Detected; Countermeasures=Jamming
 - d. Missile_Lock=Clean; Response=Inaudible; Countermeasures=Jamming; Electronic_Warfare=Detected
 - e. Response=No Response; Missile_Lock=Clean; Electronic_Warfare=Detected; Countermeasures=Jamming

3. Which of the following actions should you take if you know the following information: Signal_Strength is Medium; Electronic_Warfare = Detected; Maneuvering_Pattern is Code Delta; Countermeasures = None?

a. Choose ENGAGE = Shoot *c. Get Missile_Lock from Alpha e. Choose ID_TYPE = Air	b. Choose ID_INTENT = Hostile d. Get Initial_Range from Bravo
--	--

7. Which of the following pieces of information do you need from Bravo?

a. Countermeasures c. Missile_Lock e. Signal_Strength	b. Course *d. Response
---	---

8. Which of the following pieces of information do you need from Alpha?

- a. Electronic_Warfare
- *c. Missile_Lock
- e. Maneuvering_Pattern
- b. Speed
- d. Response

10. Which of the following is information you need to send to Bravo?

- *a. Maneuvering_Pattern
- c. Electronic_Warfare
- b. Signal_Strength
- d. Countermeasures

11. Which of the following is information you need to send to Alpha?

- a. Maneuvering_Pattern
- *c. Signal_Strength
- b. Electronic_Warfare
- d. Countermeasures

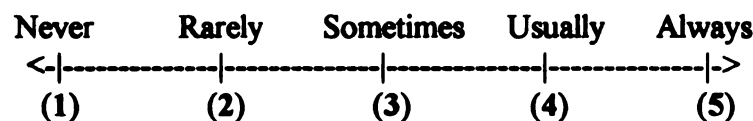
14. Which of the following is a true statement?

- *a. Alpha needs Altitude/Depth from Bravo and Signal Strength from Charlie
- b. Bravo needs Intelligence from Alpha and Signal Strength from Charlie
- c. Charlie needs Course from Bravo and Speed from Alpha
- d. Bravo needs Speed from Alpha and Course from Charlie
- e. Charlie needs Missile Lock from Bravo and Response from Alpha

15. Which of the following is an example of communication that is the most effective?

- a. Charlie to Team. Popup contact number 17 near defensive perimeter at 180 degrees, course 0 degrees, moderate speed. Process first.
- b. Charlie to Team. I just saw a popup contact appear near the defensive perimeter. It's bearing is about 180 and it's course is 0 degrees. That means it is moving toward us so I think we should probably engage it as soon as possible.
- *c. Charlie Team. C17. Popup near DP bearing 180, course 0, moderate speed. Do first.
- d. This is Charlie. Everyone, there is a popup contact I just saw pop up near the defensive perimeter at about 180 degrees that is moving at moderate speed. It's course is 0 degrees, so it is headed toward our ship and I think we should process it first.

Task Motivation



Individual

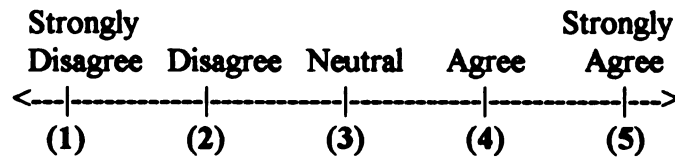
1. I was highly motivated to do well on this task.
2. I tried very hard while performing this task.
3. I continued to work hard while performing this task even when faced with difficult situations.

Team

1. The team as a whole was highly motivated to do well on this task.

2. The entire team tried very hard while performing this task.
3. The team continued to work hard while performing this task even when faced with difficult situations.

Task Satisfaction
Carsten (1987)



Individual

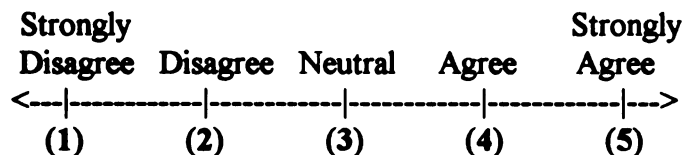
1. I am generally satisfied while performing this task.
2. I don't like performing the simulations (R).
3. I am glad that I am participating in this task.
4. I think the simulations are boring (R).

Team

5. The team is generally satisfied while performing this task.
6. No one in the team likes performing the simulations.
7. Everyone in the team is glad that we are participating in this task.

Task Withdrawal
Adapted from Baker (1991) and Gilliland (1992)

1. Would you be willing to participate in another session for follow-up purposes?
 - 1 - Yes, I'd like to participate in this experiment again whether or not I receive credit or money for participating.
 - 2 - Yes, I'd like to participate in this experiment again for credit or money.
 - 3 - Maybe I'll participate again. I'll leave my telephone number and you can contact me for a later appointment.
 - 4 - Probably not. If you get in contact with me, I probably will say no.
 - 5 - No. I'm definitely not willing to participate again.



2. I often thought about quitting this task.
3. If I hear about other projects like this, I would be interested in participating.
4. If I knew in advance what this project would entail, I would not have chosen to participate.

5. I would recommend this project to my friends.
6. I think my friends would be interested in applying for this project.

**Wonderlic Personnel Test
Wonderlic Personnel Test, Inc.**

The Wonderlic Personnel Test is a widely used short-form test to assess general cognitive ability. It consists of 50 problems that include word comparisons, disarranged sentences, sentence parallelism, direction following, number comparisons, number series, analysis of geometric figures, and story problems requiring math or logic solutions. The Wonderlic Test is a timed test that lasts for 12 minutes. It has been widely used for 57 years in business and governmental organizations to evaluate individuals for employment and training.

The Wonderlic Test used in this study is a computerized administration version of the test. This test is copyrighted by Wonderlic Personnel Test, Inc., 1509 N. Milwaukee Avenue, Libertyville, IL 60048-1380.

APPENDIX E

Appendix E

Final Task Instructions

Final Session Instructions

You and your team have had an opportunity to go through a number of training sessions to practice TAS, and have had an opportunity to learn several different things about the game. Now it is time to put everything together. Use the knowledge you and your team have gained in the previous exercises to show how proficient you are on this game. The knowledge you have gained in practicing TAS will help you to perform in this final, very challenging TAS session.

Here's the situation. Your team has been transferred to the bridge of the U.S.S. Defiant to replace her injured command team. The Defiant is already in the middle of things, and the situation is looking pretty difficult as you step in to take over. Many contacts have already penetrated the defensive perimeters, and the engagement has the potential to get out of hand. Your team must handle the tactical situation. Your team's job is to keep the situation from deteriorating further by applying all of your collective knowledge and skills. Your orders indicate that your individual goal is to do the best you can in your position. Your orders also indicate that your team goal is to do the best you can to help the team perform well. Although this is a difficult situation, the Admiral believes your team has the potential to accomplish these goals.

In addition to inheriting a situation that is difficult to begin with, there are some other things your team needs to know about this final task. Information cues for contacts will be ambiguous sometimes, just the same as before. However, there are many more contacts to deal with, and more of these contacts will be pop-ups that appear suddenly on your screen. Also, the penalty points for letting contacts enter your inner defensive perimeter has changed. In the practice sessions, the inner defensive perimeter only cost you 50 points each if a contact crossed the perimeter. In this final session, the inner defensive perimeter will cost 150 points if you allow contacts to enter. In this final session, the accuracy of the Engage decision is more important. Previously, an accurate Engage decision added 100 points to your individual score and 60 points to your team score. Now it will add 200 points to your individual score and 120 points to your team score. To make the situation more realistic, immediate feedback about the decision (correct/incorrect) is no longer available. TAS features that are different in this final session are in bold letters:

<u>Feature</u>	<u>Practice Sessions</u>	<u>Final Session</u>
Information Cues ambiguous	2 cues ambiguous	2 cues
Number of contacts	Less	More
Pop-Up Contacts	Less	More
Defensive Perimeter	-50 points	-150 points
Individual Score Engage Decisions	+100 points correct -50 points each off	+200 points correct -100 points each off
Team Score Engage Decisions	+60 points correct -30 points each off	+120 points correct -60 points each off
Feedback	Available	Not Available
Scores	Don't count	Count

In this final session, your individual and team scores count. It is time for you and your team to show how much you have learned and how well you can do on this difficult and challenging version of TAS.

Your individual and team goal for this session is to do the best you possibly can to get a high Individual Score and a high Team Score.

Take a couple of minutes to read these instructions, think about what you have learned, and think about using a strategy to deal with the changes you and your team will face in this task.

Do you have any questions? If not, let's begin the final session.

APPENDIX F

Appendix F

Debriefing Form

Team Training and Decision Making Effectiveness

This study is designed to help us understand how individuals in team contexts can effectively learn a complex job so that they can successfully perform their tasks under difficult conditions. This interest partially stems from several high profile incidents involving poor decision making by teams. In one case, the USS Stark failed to take action against a hostile aircraft which fired on the ship, injuring and killing people on board and causing great damage to the ship. Several years later, the USS Vincennes mistakenly shot down an Iranian commercial airliner, resulting in the death of many civilians. Recently, a U.S. helicopter was also mistakenly identified as an enemy aircraft and was shot down. Also, FAA investigations of aircraft crashes suggest that up to 70% of these crashes involve poor teamwork and decision making. Your participation in this experiment today will help to identify effective ways to train members of teams so they won't make these deadly errors in complex situations. Little is known about the factors that impinge on team training effectiveness. Recent research has highlighted the importance of feedback, goals, and confidence for individual learning. The current study is designed to extend research involving individuals to learning and skill acquisition in team contexts.

During the study, you operated a radar simulation which required you to work as a team to gather information about objects on you screen and take actions based on that information. In this study, different teams had different types of information about their performance. These types of information were expected to have differential effects on perceptions of confidence, goals, and learning.

During and following the simulation, you answered a number of questions about the simulation and your team. We will use this information to link your beliefs about the team to your goals and what you learned about the task. One of the key issues we will investigate is the impact of the content of your learning on how your team performed as a unit.

If you have any questions about this study or would like to receive a copy of the results when they are complete, please notify the investigator now. If you have any questions about the study or would like to receive the results when they are complete, please call the investigator listed below. Finally, thank you for participating in this study. We tried to make it as interesting for you as possible and are open to suggestions. So, if you think we can improve this study in any way, please feel free to talk to us now or in the future.

Investigator

Stanley Gully, 123-4567

APPENDIX G

Appendix G

Descriptions of Data from the Simulation

DATA FILE FOR TEAM VARIABLES

FileName	TScore	#Eng..	#EngCr	#TypeC	#C/MCr	#DtInC	#FECor
12350000	-1070	13	0	5	9	7	4
#Symbl	#Zm_In	#ZmOut	TotalQT	SpeedT	AltitT	Clm/DT	SS..T.
60	0	4	3.52	0.17	0.17	0.17	0.16
CT..T.	BerngT	RangeT	IN..T.	DO..T.	MP..T.	CM..T.	EW..T.
0.16	0.62	0.83	0.16	0.38	0.10	0.17	0.00
TL..T.	RI..T.	ML..T.	TotIQ#	Speed#	Altit#	Clm/D#	SS.#..
0.11	0.16	0.16	29	1	1	1	1
CT..#.	Berng#	Range#	IN..#	DO..#.	MP..#.	CM..#.	EW..#.
1	5	7	2	4	2	1	0
TL..#.	RI..#.	ML..#.	SimDur	PnltyT	PenPts	#InPn1	#InPn2
1	1	1	4416	-1325	0	23	22
#InPn3	#InPn4	#InPn5	AvgPnT				
22	12	8	0.0				

The variables presented are:

FileName	8-digit user number entered in Gotandem										
TScore	total score for the team										
#Eng..	total number of contacts engaged by the team										
#EngCr	total number of contacts correctly engaged by the team										
#TypeC	# contacts engaged with type dimension correctly labelled by the team										
#C/MCr	"	"	class	"	"	#DtInC	"	"	intent	"	"
#FECor	"	"	engage	"	"						
#Symbl	total number of times the type, class, or intent decisions are changed										
#Zm_In	total number of times the zoom in function was invoked by the team										
#ZmOut	total number of times the zoom out function was invoked by the team										
TotalQT	sum of the time spent by the team querying the following 15 variables (SpeedT through ML..T.)										
SpeedT	time spent by the team querying the speed variable (seconds)										
AltitT	"	altitude		Clm/DT	"	initial climb/dive					
SS..T.	"	signal strength		CT..T.	"	communication time					
BerngT	"	initial bearing		RangeT	"	initial range					
IN..T.	"	intelligence		DO..T.	"	direction of origin					
MP..T.	"	manverng patt		CM..T.	"	countermeasures					
EW..T.	"	electr warfare		TL..T.	"	threat level					
RI..T.	"	response		ML..T.	"	missile lock					
TotIQ#	sum of the number of queries by the team for the following 15 variables (Speed# through ML..#.)										

Speed#	number of times the speed variable was queried by the team			
Altit#	"	altitude	Clm/D#	" initial climb/dive
SS..#.	"	signal strength	CT..#.	" communication time
Berng#	"	initial bearing	Range#	" initial range
IN..#.	"	intelligence	DO..#.	" direction of origin
MP..#.	"	manverng patt	CM..#.	" countermeasures
EW..#.	"	electr warfare	TL..#.	" threat level
RI..#.	"	response	ML..#.	" missile lock
SimDur	the length of time the simulation was running (seconds)			
PnltyT	the total time during which any contact was in any penalty circle (defensive perimeter)			
PenPts	the total number of points deducted for contact(s) entering the penalty circle(s) (defensive perimeters)			
#InPn1	# contacts that entered the first (largest) penalty circle (defensive perimeter)			
#InPn2	"	second	#InPn3	" third
#InPn4	"	fourth	#InPn5	" fifth (smallest)
AvgPnT	the sum of the amount of time each contact spent in a penalty circle (defensive perimeter) divided by #InPn1 (number of contact(s) in any penalty circle)			

Notes:

1. #InPn? variables: there is overlap among them because the penalty circles (defensive perimeters) are concentric (ex. any contact in penalty circle three will be counted for the #InPen1 through #InPen3 variables).
2. The PnltyT and AvgPnT variables are almost always different. PnltyT doesn't take into account multiple contacts in the penalty circles (defensive perimeters) which may enter/leave at different times.
3. In team files, the thirty-two (32) query variables (TotalQT through ML..#.) represent totals for the team. These values are calculated as the sum of the values for all team members (i.e. SpeedT(team) = SpeedT(Alpha) + SpeedT(Bravo) + SpeedT(Charlie)).

DATA FILE FOR INDIVIDUAL POSITIONS

FileName	ScoreI	#Eng	#EnC	#TypC	#C/mC	#IntC	#FeC	#TypI	#C/ml
12350000	-750	3	0	0	3	0	0	2	4
#IntI	#FEI	#Sym	#ZmI	#ZmO	HookdT	TotalQT	SpeedT	AltitT	
0	3	16	0	1	248.0	0.23	0.00	0.00	
Clm/DT	SS..T.	CT..T.	BerngT	RangeT	IN..T.	DO..T.	MP..T.		
0.00	0.00	0.00	0.17	0.06	0.00	0.00	0.00		
CM..T.	EW..T.	TL..T.	RI..T.	ML..T.	TotlQ#	Speed#	Altit#		
0.00	0.00	0.00	0.00	0.00	3	0	0		
Clm/D#	SS..#.	CT..#.	Berng#	Range#	IN..#.	DO..#.	MP..#.		
0	0	0	2	1	0	0	0		
CM..#.	EW..#.	TL..#.	RI..#.	ML..#.					
0	0	0	0	0					

FileName	the 8-digit user number entered in Gotandem
ScoreI	this individual's score
#Eng	total number of contacts engaged by this user
#EnC	total number of contacts correctly engaged by this user
#TypC	number of contacts engaged by the team for which this user correctly labelled the type dimension
#C/mC	" " class " " #IntC " " intent " "
#FeC	" " engage " "
#TypI	number of contacts engaged by the team for which this user incorrectly labelled the type dimension
#C/mI	" " class " " #IntI " " intent " "
#FEI	" " engage " "
#Sym	total number of times the type, class, or intent dimensions of a contact are changed by this user
#ZmI	total number of times the zoom in function was invoked by this user
#ZmO	total number of times the zoom out function was invoked by this user
HookdT	the total time the user was hooked on a contact

TotalQT through ML..#.

The remaining thirty-two (32) variables presented on the log file status line have the same description as the same variables in the Team/Standalone files. They are listed in the individual files because they represent the querying done by this user only. The team version of these variables is simply an aggregation of the values for these variables for each team member.

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LIST OF REFERENCES

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