Summer 1996

Task Interdependence and Teamwork Processes

Kristin Krahl
Old Dominion University

TASK INTERDEPENDENCE AND TEAMWORK PROCESSES

by

Kristin Krahl

B.S. May 1994, Pennsylvania State University

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

MASTER OF SCIENCE

PSYCHOLOGY

OLD DOMINION UNIVERSITY
August 1996

Approved by:

_____
Terry L. Dickinson (Director)

_____
Debra A. Major (Member)

_____
Peter J. Mikulka (Member)

ABSTRACT

TASK INTERDEPENDENCE AND TEAMWORK PROCESSES

Kristin Krahl
Old Dominion University, 1996
Director: Dr. Terry Dickinson

In today's continually expanding and global marketplace, organizations are increasingly relying on teams. The tasks that are performed by these teams are requiring greater interdependency among members as technology becomes more complex. Therefore, there is a need for a valid measure to study the task interdependence among team members. This study developed a measure of task interdependence and provided evidence for the construct validity of the measure using LISREL (Joreskog & Sorbom, 1993). In particular, the task interdependence measure was shown to be distinct from teamwork measures developed in previous research (Rosenstein, 1994). A structural model of relationships among teamwork and task interdependence measures was also assessed. Most of the proposed structural coefficients were found to be statistically significant, and goodness-of-fit indices indicated that the model fit the data well. Suggestions concerning future research and practical implications are also discussed.

DEDICATION

This thesis is dedicated to

my parents, Judith and Joseph Krahl

and in loving memory of my grandmothers,

Martha Munley

and

Mary Krahl

Their love, guidance, support, and sacrifices gave me the opportunity, courage, and motivation to excel in life and to be the best person that I could possibly be.

ACKNOWLEDGMENTS

There are several people that deserve acknowledgment in this section. Most of all, my parents deserve mentioning because without them I would not be where I am today. They have always been my support system and to them I owe everything. I must also give credit to my brothers, Mike and Steve, who have always been there to provide me with a helping hand or some brotherly advice. In addition to the rest of my family, my best friends, Katie and Becky, deserve mentioning for all their unconditional encouragement and support.

Many of my professors and friends at Old Dominion University have helped me in one way or another, but I am especially grateful to Dr. Terry Dickinson. I am very appreciative for all the time and effort he has given to me and to his never ending words of wisdom. I am also thankful to my committee members, Dr. Debra Major and Dr. Peter Mikulka, for the time they have committed to the development and implementation of this thesis.

TABLE OF CONTENTS

Page

LIST OF TABLES vii

LIST OF FIGURES. viii

Chapter

1. INTRODUCTION. 1

TASK INTERDEPENDENCE. 2
TEAMWORK COMPONENTS 5
COMMUNICATION. 7
TEAM ORIENTATION 8
TEAM LEADERSHIP. 10
MONITORING 11
FEEDBACK 12
BACKUP BEHAVIOR. 13
COORDINATION 14
RESEARCH PURPOSE. 16
HYPOTHESES. 16

2. METHOD. 18

PARTICIPANTS. 18
MEASURES. 18
TEAMWORK AND PERFORMANCE SCALES. 21
TASK INTERDEPENDENCE SCALE 21
PROCEDURE 22
CONSTRUCT VALIDITY. 22
ANALYTIC STRATEGY 23
SUBSCALES. 23
MEASUREMENT MODEL ANALYSES 24
STRUCTURAL MODEL ANALYSIS. 24
GOODNESS-OF-FIT INDICES. 24

3. RESULTS 26

OVERVIEW. 26
CONFIRMATORY FACTOR ANALYSES. 26
MEASUREMENT MODEL ANALYSES. 28
STRUCTURAL MODEL ANALYSIS. 34

4. DISCUSSION 35

GENERAL FINDINGS 35
CONFIRMATORY FACTOR ANALYSES. 36
MEASUREMENT MODELS. 37
STRUCTURAL MODEL. 42

TABLE OF CONTENTS (CONTINUED)

Page

LIMITATIONS OF THE STUDY AND DIRECTIONS FOR FUTURE RESEARCH. 41
PRACTICAL IMPLICATIONS 42
CONCLUSION 43

REFERENCES 45

APPENDICES

A. BACKGROUND INFORMATION. 50

B. TASK INTERDEPENDENCE AND THE TEAMWORK COMPONENTS' SCALES. 52

C. CONFIRMATORY FACTOR ANALYSES. 64

D. ITEMS USED FOR THE CONSTRUCTION OF SUBSCALES. 75

E. MEANS, STANDARD DEVIATIONS, AND CORRELATIONS FOR SUBSCALES 78

F. MEASUREMENT MODEL ANALYSIS FOR THE DEPENDENT LATENT VARIABLES 82

G. MEASUREMENT MODEL ANALYSIS FOR THE INDEPENDENT LATENT VARIABLES 85

H. STRUCTURAL MODEL ANALYSIS FOR INDEPENDENT AND DEPENDENT LATENT VARIABLES. 88

VITA 93

LIST OF TABLES

TABLE Page

1. Demographic Information About Participants 19

2. Summary of Confirmatory Factor Analyses. 27

LIST OF FIGURES

FIGURE Page

1. Hypothesized teamwork model. 6

2. Structural coefficients for the hypothesized teamwork model. 33

CHAPTER I

INTRODUCTION

As work has increased in technological complexity, organizations are relying more on teams for accomplishing organizational goals. Indeed, organizations must use teams in order to compete in the global marketplace and respond to the demands of technology. The work tasks created by technology often cannot be accomplished by a single individual and require usage of teams. Of course, individual performance is important, but organizations are becoming increasingly dependent on team performance. Thus, an understanding of teams and teamwork processes are critical to the success of organizations.

Two widely quoted definitions of teams reflect the nature of teams and teamwork processes. Teams have been defined as: (a) "a distinguishable set of two or more individuals who function together to accomplish a specific goal" (Dieterly, 1988, pp. 766-767), and (b) "a distinguishable set of two or more people who interact, dynamically, interdependently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership" (Salas, Dickinson,

---

This thesis employs the following style manual: American Psychological Association (1994). Publication manual of the American Psychological Association (4th ed.). Washington, DC: Author.

Converse, & Tannenbaum, 1992, p. 4).

Although the terms group and team are often used interchangeably in the literature and in everyday language, these terms have different meanings. As was stated previously, the critical aspect of a team is their functioning together to accomplish a specific goal. Members should see themselves as mutually dependent, and they should work interactively toward accomplishing a goal. Thus, the continuous collaboration of team members is important for obtaining coordinated and effective team performance (Dieterly, 1988).

On the other hand, a group does not require interaction among members in order for group members to complete their individually assigned tasks. Individual tasks may be accomplished through each member's own resources, regardless of the remaining members in the group. Each of the members in a group does not need input from other members to do his/her job effectively. Driskell and Salas (1992) stated that a more proper name for a group is an aggregate because its members are "a set of disparate individuals in a group context" (p. 278).

Task Interdependence

A critical determinant of teamwork is the presence of task interdependencies among team members, because these relationships influence how team members must work together in order to accomplish their individual and team goals.

Task interdependence has been defined by many in the literature (Dailey, 1980; Mohr, 1971; Pennings, 1974; Thompson, 1967; Van de Ven, Delbecq, & Koeing, 1976). All the definitions have the same underlying theme that the task dictates the degree to which members must collaborate and work together.

Pennings (1974) suggested that the general concept of interdependence can be conceptualized as four different aspects: task, or the flow of work between members; role, or the work positions of members; knowledge, or the position skills of members; and social, or the mutual goals and needs of the members. This is a broader view of interdependence compared to Thompson (1967), who focused solely on task interdependence. Thompson viewed task interdependence as the flow of work, materials, and objects between team members. This latter view of task interdependence was the one adopted for the present research.

Thompson (1967) suggested an hierarchy of work-flow. Independent or pooled work-flow, which was the lowest on the hierarchy, referred to activities performed by one individual that did not flow between members. Sequential work flowed between members only in one direction. Activities that flow back and forth between members constituted reciprocal work-flow.

Van de Ven et al. (1976) extended Thompson's three types of work-flow to include team arrangement. The team

arrangement level of interdependence involved all team members working on a task and engaged in diagnoses, problem-solving, and collaboration. In this type of work-flow, members simultaneously work on the task at hand. For example, firefighters work together to extinguish a burning building. In contrast, a sequential work-flow requires members to wait until another member has completed a task. Assembly line workers exemplify a sequential work-flow because each employee is dependent on an adjacent employee's task completion.

It is not correct to say that all members of a team must have a high degree of task interdependence. For example, one can look at a jury; each individual juror makes a decision, but in order to reach a verdict all jurors must pool their decisions together. Each individual juror can make his/her own decision, but no verdict can be made without the contribution of every member. In terms of Thompson's hierarchy of work-flow, this situation would be considered an independent or pooled work-flow, which is the lowest level of task interdependence on the hierarchy.

On the other hand, some athletic teams (e.g., football, basketball) require that all members work together in order to achieve their goals. No member can work alone, and each member needs at least one other member to complete his/her individual tasks. These athletic teams reflect high levels of task interdependence.

As can be seen from the examples given above for a jury and athletic teams, teams vary on a continuum from low to high task interdependence. When there is low task interdependence, members have little interaction and coordinated activity. On the other hand, when high task interdependence exists, members in a team have greater member-member collaboration and coordinated activity. Clearly, greater coordination is needed among team members as task interdependence increases from an independent to a team arrangement.

Teamwork Components

All teams can be viewed as consisting of members who coordinate their energy, ideas, and activities by communicating, influencing, and exchanging resources (Tjosvold, 1990). This coordination of members' activities is critical for effective team performance. Several components are recognized as being antecedents for effective team performance (Dickinson, McIntyre, Ruggeberg, Yanushefski, Hamill, & Vick, 1992; Rosenstein, 1994). These components include communication, team orientation, team leadership (i.e., consideration and initiating structure), monitoring, feedback, backup behavior, and coordination. The teamwork components and their interrelationships are shown in Figure 1. In addition, the figure depicts the relationships of the teamwork components to task interdependence and team performance.

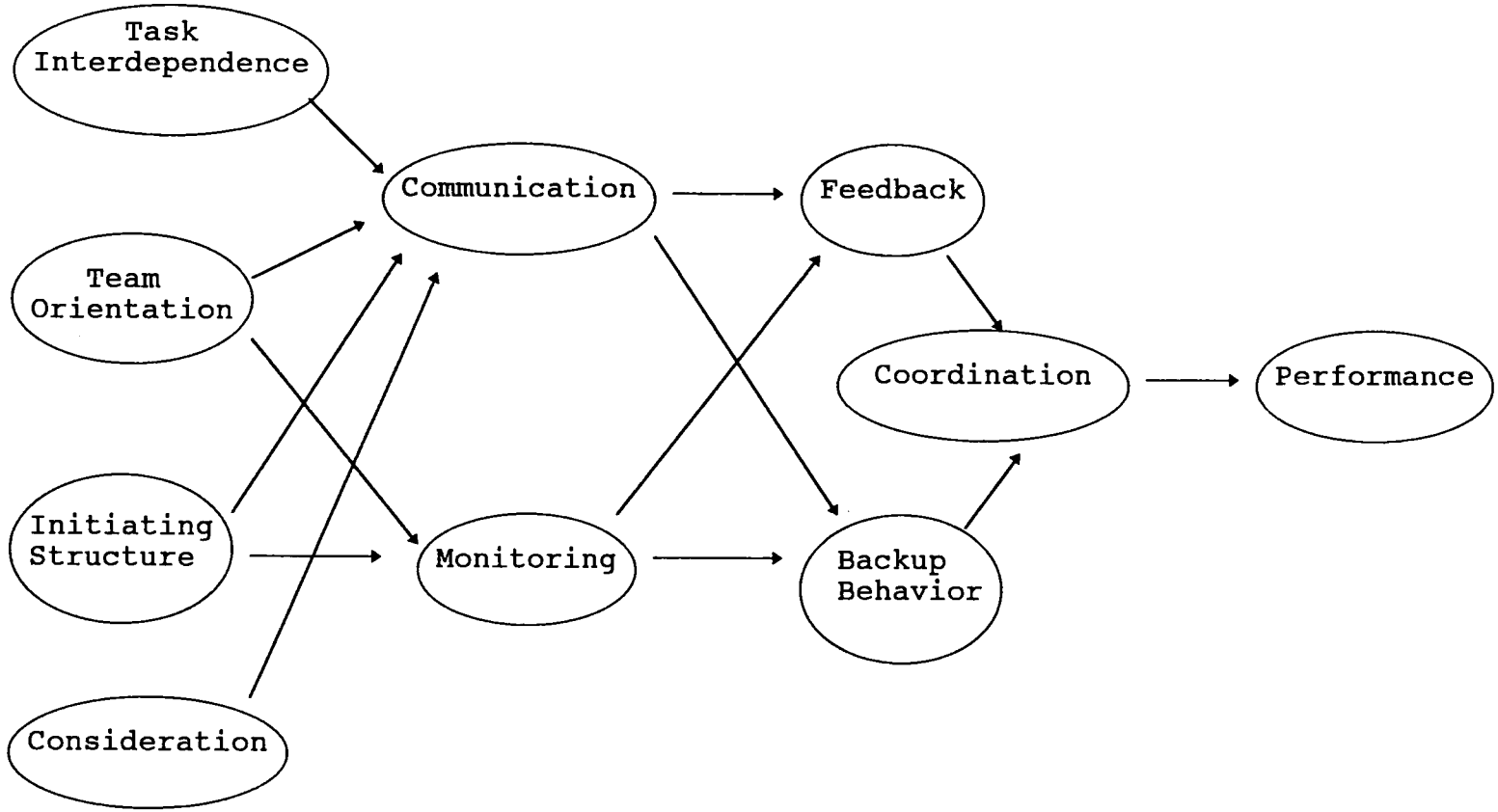

Figure 1. Hypothesized teamwork model.

Communication. Communication is seen as a process variable that reflects the dynamics of group interaction (Foushee & Helmrich, 1988). The active exchange of information is a key linkage to the other components of teamwork, and this exchange is greatly influenced by the team task design.

The team task design consists of those tasks that are necessary for members to complete in order to achieve the team objective. Dieterly (1988) states that the importance of teamwork increases with the extent of task interdependencies reflected in the team task design. For example, under conditions of high task interdependence where member interaction is critical for the completion of tasks, communication must increase among members for the team to be successful. If members hold important information (i.e., high task interdependency) that would be beneficial to the team as a whole, communication among members must be high. Clearly, if an individual member decided to withhold or distort information, it would be detrimental to team coordination and performance.

Smith (1979) conducted a study that illustrates the importance of communication in a team performing a highly interdependent team task. This research utilized a realistic simulation that required qualified B-747 crews to fly from New York to London. During the flight, the crew was forced to shut down an engine due to a mechanical

problem. This problem was compounded by an hydraulic system failure, bad weather, and poor air traffic control. These difficulties forced the crew to make a decision concerning where to land the plane. Among other things (i.e., crew coordination, decision making, planning skills), cockpit communication was an essential requirement for successful performance. Smith (1979) recorded cockpit communication and found that "high-error" crews communicated much less and failed to exchange information in a timely manner compared to "low-error" crews.

Team orientation. As a consequence of the work interaction process, team members react to each other regarding information exchange, expressing feelings, forming coalitions, or supporting/rejecting the team leader (Guzzo & Shea, 1992). The interpersonal relationships that are formed from this interaction process can have a profound effect on the actions, thoughts, and feelings of members. Team orientation, therefore, is a necessary component to analyze when studying teamwork processes. It refers to "the attitudes that team members have toward one another and the team task. It reflects acceptance of team norms, level of group cohesiveness, and importance of team membership" (Dickinson et al., 1992. p. 48).

The two facets important in team orientation are norms and cohesiveness. Norms are "the expectations that make up roles and give shape to interpersonal relations" (Wagner &

Hollenbeck, 1995, p. 281). As members work together and share their ideas and beliefs, powerful norms are formed that essentially mold the behaviors of all team members. The norms created in a team can indirectly affect many teamwork components. For example, a team's norm may be to exchange information in an efficient and timely manner. A norm such as this is very important when communication among members is critical. If this norm is not established or if there is an implicit norm to withhold information from other members, then all other teamwork processes (i.e., monitoring, feedback, backup behavior, coordination) would be affected; as a result, team performance would suffer greatly.

The conformity to group norms may depend greatly on another facet of team orientation, cohesiveness, which is the sum of the forces that bind (or attract) team members to each other and to their team (Guzzo & Shea, 1992). As a team's cohesiveness increases, members' conformity to group norms increases. Two reasons have been suggested as to why this phenomenon occurs (Hackman, 1992). First, the pressure to conform and be uniform is greater in highly cohesive teams compared to those teams that are not cohesive (Festinger, 1950). Second, members in highly cohesive teams value interpersonal rewards very strongly; thus, team members would not risk losing these rewards by defying or ignoring the norms.

Although communication is usually positively affected by team orientation, this is not always the case. As a matter of fact, some norms may negatively affect team performance. This could occur for a team with norms that restrict communication, particularly when there is high task interdependence among members.

The cohesiveness aspect of team orientation may also have a direct impact on the extent to which team members monitor one another. A team comprised of members who have poor attitudes toward one another may result in little monitoring, and this will in turn affect backup behaviors. Members would not be aware of or motivated to perform the necessary actions to aid other members' performances. Members would also be deficient in providing appropriate feedback. If members have not effectively monitored other members' performances because of attitudinal problems within the team, then they could not provide the feedback that is necessary for good team performance.

Team leadership. Another component that has a direct effect on communication among members, which in turn affects the remaining teamwork components, is team leadership. Team leadership is conceptualized as two distinct but correlated sets of behaviors (Rosenstein, 1994): consideration and initiating structure. Thus, each of these sets of leadership behaviors is considered a latent variable in Figure 1.

Leadership behaviors oriented toward initiating structure are those concerned with meeting the team's task requirements (i.e., following rules, establishing performance standards, clarifying roles, and setting goals) (Wagner & Hollenbeck, 1995). On the other hand, considerate leadership behaviors are concerned with meeting the social and emotional needs of workers (i.e., providing help, doing favors, looking out for their best interests, and explaining decisions) (Wagner & Hollenbeck, 1995,).

Initiating structure plays a role in the effectiveness of members' monitoring behaviors and communication among members. For example, in a highly interdependent team task where sharing task-related information among members is important, an orientation toward initiating structure enables monitoring of performance standards and communication of roles and goals. Thus, initiating structure affects both communication and monitoring in a team.

Considerate leadership behaviors would not affect monitoring in a team because these leadership behaviors are less concerned with the work activities and performance of team members. However, considerate leadership behaviors are concerned with the emotional and social needs of the members and are likely to influence communication between members.

Monitoring. Monitoring occurs when team members observe the activities and performance of other members.

Monitoring the work activities of other members is necessary for providing feedback about those activities, and also for providing backup behaviors. A member must first be competent in his/her own tasks to understand the tasks of the other members; therefore, competency is a prerequisite to providing appropriate feedback and backup to another member (Dickinson et al., 1992, p. 36).

It has been suggested that the relationship between monitoring members and providing feedback is moderated by communication. When members communicate with one another concerning what each has observed in the team, monitoring can be seen as a source of extrinsic feedback. Extrinsic feedback occurs when an external force, rather than the task itself, provides feedback (Wagner, Hibbits, Rosenblatt, & Salas, 1977).

When team orientation and team leadership provide the context for monitoring to take place, members will monitor other members' performance and behaviors and provide feedback. Therefore, all things being equal, monitoring becomes a more important teamwork component in situations of high task interdependence where feedback is more likely to be necessary compared to low task interdependence where feedback is less necessary.

Feedback. There are several sources for obtaining feedback about performance. Ilgen, Fisher, and Taylor (1979) classify the sources of feedback as one's self, other

individuals, or the task itself. In a situation where the task dictates that team members must work together to perform successfully, and the task itself does not provide feedback, it is very important for members to provide feedback to each other. This is especially true in situations where information must be given in order to ensure the safety of team members and/or the success of the team. Accordingly, the feedback component emphasizes the sharing of information among team members. Feedback is defined as (Dickinson et al., 1992, p. 48):

> the giving, seeking, and receiving of information among group members. Giving feedback refers to providing information regarding other members' performance. Seeking information refers to requesting input or guidance regarding performance. Receiving feedback refers to accepting positive and negative information about performance.

The sharing of information about performance is obviously necessary in teams because it results in effective coordination among team members. When appropriate feedback has been given it increases members' understanding of their responsibilities/duties and increases the team's chances for successful performance.

Backup behavior. Backup behavior is concerned with assisting other team members with their tasks. It implies that members have an understanding of other members' tasks, and also that members are willing and able to provide and seek assistance when needed (Dickinson et al., 1992, p. 48). Team members usually provide backup behaviors in cases of

emergency or when another member becomes overwhelmed with work activities. Therefore, when there is a problem within the team, members must work together and assist each other in order to overcome the problem and perform successfully.

Previous research (Dickinson et al., 1992; Rosenstein, 1994) suggests that communication indirectly affects the relationship between backup and coordination. For example, if one member is providing assistance to another member, it may be necessary to communicate what is occurring to that member as well as to the rest of the team in order to maintain coordination throughout the team. This is particularly the case for team tasks with high interdependence. However, in team tasks that require only low levels of interdependence, communication of backup behaviors may not be as important due to the great deal of independence among members' activities.

Coordination. Coordination among members reflects the merging of individual actions and is critical for effective team performance. Task interdependence indirectly affects the coordination among team members, because members in a team with a highly interdependent task must share information, pool resources, and check for errors when accomplishing tasks. Clearly, coordination is essential for team success.

Driskell and Salas (1992) confirmed the importance of coordination in teams when they found collectively oriented

teams performed better than egocentric teams. They defined collectively oriented teams as those members who have "the tendency to coordinate, evaluate, and utilize task inputs from other group members in an interdependent manner in performing a group task" (p. 278), and egocentric teams as consisting of members who ignored task inputs from other members. They suggested that collective behavior is one of the criteria for defining performance in a highly interdependent team. Collective behavior, on the other hand, is unimportant in those groups that only require low interdependence among members. In low task interdependent groups, sharing information, pooling resources, and coordinating activities are not necessary for achieving the group's objective.

Research on air crews (Foushee, 1984) suggests that several of the teamwork components affect aircrew coordination and performance. For example, Foushee (1984, p. 888) reported that a commuter carrier crashed (performance) when a first officer failed to take over the aircraft (backup behavior) after the captain became incapacitated. This captain had a tendency to ignore callouts (communication). Furthermore, the captain was visibly upset on the day of this accident and was known to have a harsh personality (leadership). The first officer was intimidated by the captain and was not willing to take over the aircraft (team orientation). This example

illustrates that many components in the teamwork process affect coordination and, in turn, performance. Therefore, coordination is affected both directly and indirectly by other teamwork components.

Research Purpose

The purpose of the present research is to investigate the relationship of task interdependence to teamwork processes and team performance. Because the interaction among members is crucial for the achievement of the team, studying task interdependence and its relation to teamwork is very important for understanding teams.

Hypotheses

A general hypothesis for this study is that the scale developed to measure task interdependence will demonstrate construct validity. Also, it is expected that task interdependence is a viable measure separate from teamwork processes (i.e., team orientation and team leadership).

Several other hypotheses are implied by Figure 1:

H_1) Task interdependence is expected to influence communication directly because each member in a team holds important information that may be relied upon by at least one other team member. Information that is distorted or withheld could result in poor team performance.

H_2) Team orientation and initiating structure are expected to affect directly the communication and monitoring among members, but they do not have a direct relationship

with task interdependence. Team orientation and initiating structure are more concerned with the attitudes toward team members and the guidance of members with respect to the team task.

H_3) Consideration is expected to affect communication directly. This aspect of team leadership is concerned with the emotional and social needs of members.

H_4) Communication and monitoring are expected to influence feedback and backup behavior directly. Greater monitoring on the part of team members gives them the knowledge to backup other team members and provide feedback to members. Backup and feedback may not take place, however, if team members are not properly communicating to each other and monitoring one another.

H_5) Feedback and backup behavior are expected to directly impact coordination. Feedback and backup provided to members increase their ability and individual performance, and together, feedback and backup influence the coordination among members.

H_6) Coordination is expected to be influenced indirectly by task interdependence and the remaining teamwork components.

H_7) Coordination is expected to directly impact performance. Members who coordinate their activities with other members perform better than those who do not coordinate their activities.

CHAPTER II

METHOD

Participants

Sixty male and 165 female undergraduate students at Old Dominion University participated in this study. Participants ranged in age from 17 to 42 with a mean age of 21.54. All participants received extra credit in exchange for participation.

This study included only those individuals who had been a member of a team at some time in their life. A background measure was used to document prior team experience (see Appendix A). It investigated the length of time as a team member, the length of time since participating on the team, total number of members on the team, type of team, and the major activities of the team.

The demographic characteristics of the participants and their teams are presented in Table 1. As can be seen in Table 1, the participants were typically members of a team for two years, on teams with approximately 19 members, and last participated as members more than two years ago. Table 1 also describes the type of teams and specific examples of teams included in the research.

Measures

The scales that were used to measure the various teamwork components, team performance, and task interdependence scales are described in the following

Table 1

Demographic Information About Participants

Length of Time Since Participating on Team
Minimum = 1 month
Maximum = 23 years
Range = 23 years
Mean = 2.70 years

Length of Time as a Team Member
Minimum = 1 month
Maximum = 9 years
Range = 8.92 years
Mean = 2.40 years

Number of Members on a Team
Minimum = 3 members
Maximum = 215 members
Range = 212 members
Mean = 19.32 members

Type of Teams:

(1) Military Group = 2
- -Army paratrooper team
- -Army reserves unit

(2) Community Sports Teams = 6
- -handball
- -baseball
- -basketball
- -volleyball
- -softball

(3) High School/College Sports Teams = 102
- -wrestling
- -crew
- -basketball
- -volleyball
- -lacrosse
- -softball
- -tennis
- -swim
- -field hockey
- -football
- -golf
- -baseball
- -track and field
- -sailing

(4) Community Group = 7
- -church youth organization
- -brownie leader group
- -HIV/AIDS support group
- -multiple sclerosis group

(5) College Organization = 8
- -international student group
- -newspaper staff
- -intervarsity Christian fellowship group
- -minority student union
- -student council

Table 1 (continued)

(6) Work Group = 27

-sales team	-restaurant staff
-engineering group	-computer design team
-cardiac transportation team	-advisory board
-department store	-shipping department
-human resources team	-television crew team

(7) High School Organization = 57

-newspaper staff	-marching band
-cheerleading squad	-student council
-flag/drill team	-yearbook staff
-theater group	-international club
-chorus	-forensics debate team
-literary magazine staff	-parliamentary law team
-dance group	-Spanish club

(8) School Project Teams = 12

-advertising	-counseling
-I/O psychology	-oceanography
-science	

paragraphs.

Teamwork and performance scales. The present research adopted scales developed in previous research (Dickinson et al., 1992; Rosenstein, 1994). These scales measured team orientation, team leadership, communication, monitoring, feedback, backup behavior, coordination, and performance. These scales can be seen in Appendix B.

The definition of a teamwork component was included on each scale along with 9 to 12 behavioral items to be rated. A 5-point scale ranging from 1 (Almost Never) to 5 (Almost Always) was used to rate each item's frequency of occurrence.

Task interdependence scale. The items for the task interdependence scale were generated by the author or modified from existing measures (i.e., Hall, 1988; Kiggundu, 1983; Rosenstein, 1994; Ruggeberg, 1996). Existing measures were not adapted in full because they did not adequately measure task interdependence as defined in the context of this research. The current scale reflects the extent to which team members are dependent upon information or resources from other members to accomplish individual tasks and the objective of the team.

The task interdependence scale also included a definition along with 15 behavioral items to be rated. A 5-point scale ranging from 1 (Almost Never) to 5 (Almost Always) was also used to rate the degree of task

interdependence. This scale can be seen in Appendix B.

Procedure

Participants were given a brief introduction to the research and asked to read and sign an informed consent form. Next, background information was collected from each individual, including information about team experiences. Next, a questionnaire containing all scales (i.e., teamwork, performance, and task interdependence) was administered to each participant. Participants were asked to remember and rate their experiences as previous members of a team. After completing the scales, the participants were debriefed and dismissed.

Construct Validity

Construct validity is established when a variable measures what it is intended to measure (Cote, Buckley, & Best, 1987). LISREL VIII (Joreskog & Sorbom, 1993) was used to assess the construct validity for the task interdependence scale as well as the remaining scales included in the present study.

A maximum likelihood confirmatory analysis was conducted on each of the scales to assess the unidimensionality of their items. A set of items that measures a single construct possesses unidimensionality. Particular attention was given to the task interdependence scale. Confirmatory factor analyses were performed in a previous study for the teamwork and performance scales

(Rosenstein, 1994). Similar to Rosenstein's study, items with factor loadings above .40 in each factor analysis were considered adequate to reflect unidimensionality and retained for subscale definition.

Analytic Strategy

Subscales. An algorithm was employed to define subscales for each scale. Scale items were categorized into three subscales consisting of two to three items. The purpose of forming subscales is to avoid the magnitudinal restrictions on Pearson product moment correlations and to reduce associated non-normality problems that occur with the usage of item-level information (Drasgow & Kanfer, 1985). These difficulties can lead to an inadequate fit for a structural model. As a general rule, it is important to have three indicators (i.e., subscales) for each latent variable of a measurement model in order to assess the structural model appropriately.

A technique similar to the one used by Mathieu (1991) was employed to form three parallel subscales for each latent variable for confirmatory factor analysis of the measurement model. The item with the highest loading and the item with the lowest loading comprised the first subscale. The items with the second highest and lowest loadings comprised the second subscale. The third subscale contained the item with the third highest loading and the item with the third lowest loading. The items remaining

were randomly placed in the three subscales. The subscale scores were a result of the averages of the item ratings. Eight participants were eliminated from the sample because they had missing data for one or more subscales.

Measurement model analyses. The teamwork components in Figure 1 can be divided logically into dependent (i.e., communication, monitoring, feedback, backup behavior, and coordination) and independent (i.e., team orientation, team leadership) latent variables. Measurement models were evaluated separately for independent and dependent latent variables using LISREL VIII. Task interdependence was considered an independent latent variable and was included in the model for the teamwork, independent latent variables. Performance was considered a dependent latent variable and was included in the model for the teamwork, dependent latent variables. Factor loadings, measurement error variances, goodness-of-fit indices, and modification indices were examined to evaluate each measurement model.

Structural model analysis. Structural coefficient estimates were also obtained for the hypothesized teamwork model (see Figure 1) using LISREL VIII. Both direct and indirect effects are estimated by the structural coefficients. Direct effects are the structural coefficients themselves, whereas as the indirect effects are obtained as the products of the coefficients.

Goodness-of-fit indices. The chi-square statistic and

adjusted goodness-of-fit measures assessed the fit of the solution to the sample covariance matrix. A good model fit can be identified by a nonsignificant chi-square and goodness-of-fit indices of appropriate magnitudes.

Although the chi-square statistic is often utilized to assess the fit of a model, it is affected by sample size (i.e., the magnitude of chi-square increases with sample size). In fact, Marsh, Balla, and McDonald (1988) found that investigators conducting the same research but with different sample sizes may chose different models if they rely on the chi-square as an indicator of goodness-of-fit. Therefore, the non-normed fit index (NNFI) and comparative fit index (CFI) were chosen to assess the goodness-of-fit of a particular model. They are unbiased indices and not influenced by sample size. Models with NNFI or CFI indices of .90 or greater are considered to fit the data well.

CHAPTER III

RESULTS

Overview

The results of the study are presented in three sections. First, the confirmatory factor analyses section discusses the assessment of the unidimensionality of each scale in the questionnaire. Second, the measurement model section discusses the relationship between the subscale indicators and the dependent and independent latent variables. Third, the structural model section discusses the relationships among the latent variables and model fit.

Confirmatory Factor Analyses

Appendix C presents the LISREL VIII results for the confirmatory factor analyses for all of the scales. As can be seen in Appendix C, the sample size varied for each scale (i.e., N = 110 to 231) because a listwise deletion for missing observations was used. Table 2 summarizes the number of items for the scales that had factor loadings greater than .40. As mentioned previously, items were considered for inclusion in subscales if they loaded .40 or higher on their factor.

As can be seen in Table 2, the scales used to measure each of the latent variables retained all of their items except for team orientation, consideration, and task interdependence. However, only one item from the team orientation and consideration scales did not meet the

Table 2

Summary of Confirmatory Factor Analyses

Scale	Number of items	Number of loadings >.40	CFI	NNFI
Team orientation	13	12	.80	.77
Consideration	8	7	.95	.92
Initiating structure	8	8	.92	.88
Task interdependence	15	9	.56	.48
Communication	11	11	.85	.82
Monitoring	9	9	.78	.70
Feedback	9	9	.88	.84
Backup behavior	9	9	.85	.80
Coordination	9	9	.96	.94
Performance	9	9	.93	.91

Note: Abbreviations are: CFI, comparative fit index; NNFI, non-normed fit index.

criterion of .40 or greater. Appendix D indicates the items that were used to construct subscales.

Based on the confirmatory factor analyses, sufficient items were available to form three subscales for each latent variable. These subscales were utilized to evaluate the measurement models for the dependent and independent latent variables. The means, standard deviations, and correlations for the subscales are contained in Appendix E.

Table 2 also shows that each of the scales used to measure teamwork components demonstrated moderate to high goodness-of-fit indices (i.e., ranging from .70 to .96). The 15-item task interdependence scale, however, demonstrated low goodness-of-fit indices (i.e., CFI = .56, NNFI = .48). Therefore, a confirmatory factor analysis was conducted only on the nine items that loaded greater than .40 to evaluate their unidimensionality and goodness-of fit indices. The reanalysis of the task interdependence scale revealed factor loadings ranging from .36 to .84, and goodness-of-fit indices comparable to the teamwork components. The CFI increased to .83 and the NNFI increased to .77.

Measurement Model Analyses

The measurement model for the dependent latent variables included three subscale indicators for each of the following six dependent variables: communication, monitoring, feedback, backup behavior, coordination, and

performance. Tables for the results of the measurement model are presented in Appendix F.

The measurement model for the dependent latent variables contains high factor loadings for each subscale. Also, all factor loadings demonstrate statistically significant T-values (i.e., greater than or equal in magnitude to 2.0). The moderate to high squared multiple correlations and small measurement error variances demonstrate that subscale variance is accounted for by the factors and their intercorrelations. The matrix containing the correlations between the dependent latent variables has values ranging between .37 and .80. The goodness-of-fit indices suggest that the overall model fit the data well (i.e., NNFI = .96, CFI = .97).

Tables for the results of the measurement model for the independent latent variables are presented in Appendix G. In this model, three subscale indicators were used for each of the four independent latent variables: team orientation, consideration, initiating structure, and task interdependence.

As can be seen in Appendix G, the factor loadings are high in the measurement model for the independent latent variables. All T-values are statistically significant for the factor loadings. All measurement error variances are small and, thus, all squared multiple correlation values are moderate to high. The matrix of correlations between the

independent latent variables, confirms the general hypothesis that task interdependence is a separate measure from other independent variables. Finally, the goodness-of-fit indices suggest that the independent measurement model fit the data well (i.e., NNFI = .99, CFI = .99).

Structural Model Analysis

The structural model shown in Figure 1 depicts the hypothesized relationships among the latent variables. The model reflects both direct causal effects (e.g., team orientation → communication) and indirect causal effects (e.g., task interdependence → communication → feedback → coordination). As can be seen in Figure 1, direct effects are identified by a single line between latent variables with the arrowhead indicating the direction of causality. The indirect effects are identified by a series of two or more lines with arrowheads.

In order to test the hypothesized causal relationships in the structural model, structural coefficient estimates were obtained in Beta and Gamma matrices. These matrices were set to correspond to the direct effects specified in the hypothesized model. The Beta matrix specifies the causal relationships among the dependent latent variables (e.g., communication → feedback), and the Gamma matrix specifies the causal relationships from the independent latent variables to the dependent latent variables (e.g., task interdependence → communication).

The LISREL VIII results for the structural model analysis are presented in Appendix H. The Lambda X and Lambda Y (i.e., factor loadings) matrices for the structural model are highly similar to those found for the measurement model analyses. Both results reaffirm the construct validity of the measures and their subscales.

Examination of the Beta matrix reveals that all of the hypothesized direct effects among the dependent latent variables were statistically significant (i.e., T-values were 2.0 or greater). Specifically, communication significantly impacts feedback and backup behavior, monitoring impacts feedback and backup behavior, feedback impacts coordination, backup behavior impacts coordination, and coordination significantly impacts performance.

The matrix of the indirect effects among the dependent latent variables shows that all of these effects are statistically significant (i.e., communication and coordination, communication and performance, monitoring and coordination, monitoring and performance, feedback and performance, backup and performance). The magnitudes of the effects range from .23 to .58 (see Appendix H).

Examination of the Gamma matrix reveals that most of the hypothesized structural relationships from the independent latent variables to the dependent latent variables are significant. Specifically, team orientation significantly impacts communication and monitoring,

initiating structure significantly impacts communication and monitoring, and consideration significantly impacts communication. The hypothesized direct path from task interdependence to communication, however, is not significant (i.e., T-value was less than 2.0).

The matrix of indirect effects of the independent latent variables on the dependent latent variables show that all are statistically significant except for those of task interdependence. The magnitudes of the significant effects range from .07 to .37 (see Appendix H).

The structural model and the estimates of the structural coefficients as determined by LISREL VIII are presented in Figure 2. As shown, all coefficients except the one involving task interdependence were statistically significant.

The Psi matrix indicates the amount of variance that was not accounted for by the measurement and structural models. The values in this matrix are small, ranging from .05 to .18 (see Appendix H). Furthermore, the squared multiple correlations for the structural equations are moderate to high (i.e., ranging from .46 to .82). Thus, much of the variance in the dependent latent variables is being accounted for by the independent latent variables.

Although the chi-square statistic is statistically significant (i.e., chi-square = 645.70) for the structural model, other goodness-of-fit indices suggest that the model

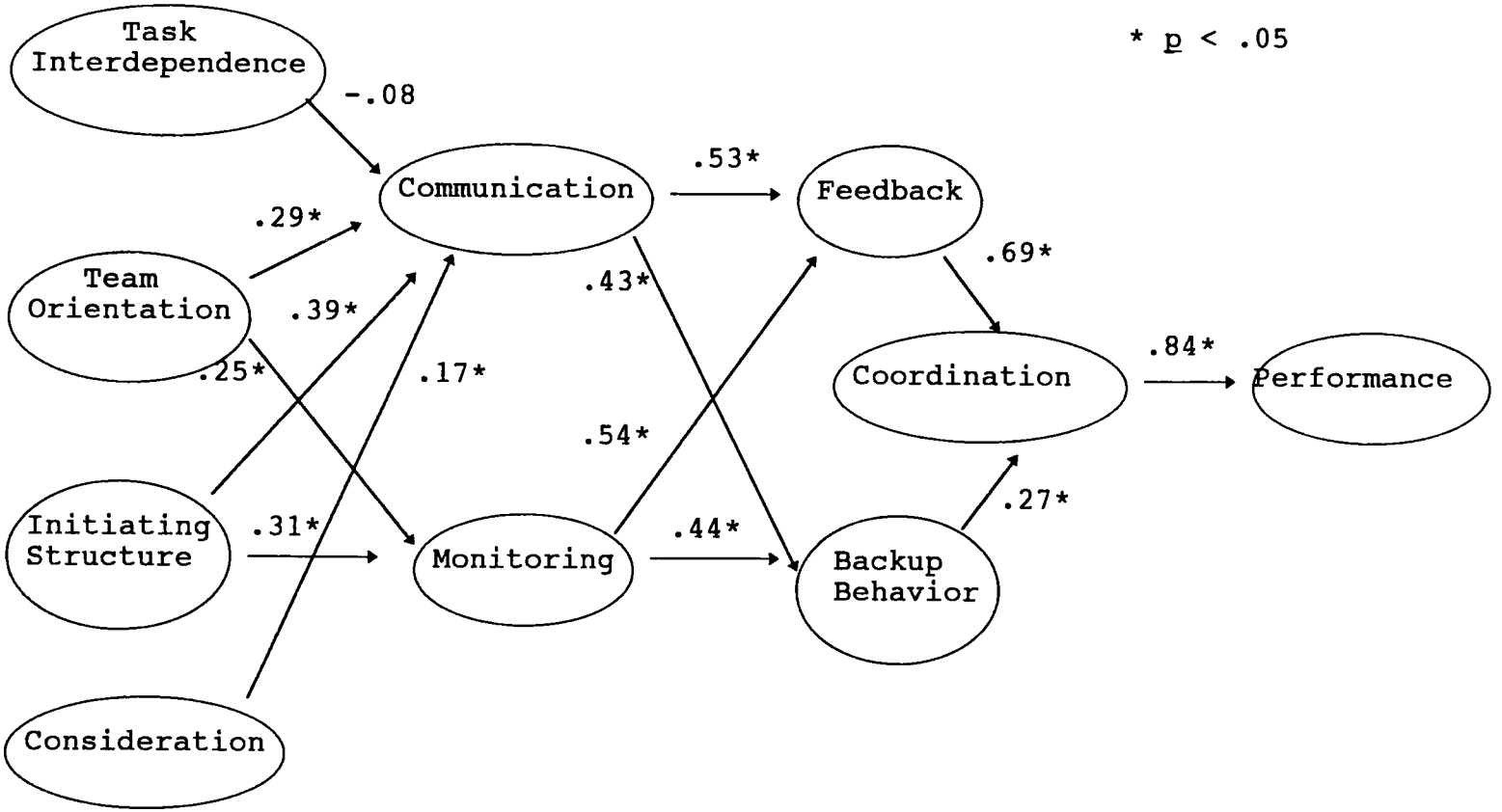

Figure 2. Structural coefficients for the hypothesized teamwork model.

fit the data well. Specifically, NNFI and CFI are both .94 for this model.

CHAPTER IV

DISCUSSION

The general findings of this study, limitations of the study, and directions for future research are discussed in the following sections.

General Findings

The current research tested a complex model of teamwork components for the purpose of examining the relationships that underlie the processes of teamwork. In addition, this study also examined the construct validity of the scales and subscales used to measure each latent variable in the model. Therefore, the sections below discuss the findings of the confirmatory factor analyses, measurement model analyses, and structural model analysis.

Confirmatory factor analyses. One of the purposes of this study was to develop the task interdependence scale and demonstrate its construct validity. In general, the task interdependence scale demonstrated construct validity through its moderate to high factor loadings. Although the goodness-of-fit indices for the 15-item scale were low, reanalysis of the scale with a subset of the items (i.e., items greater than .40) demonstrated moderate to high goodness-of-fit indices. Therefore, both the factor loadings and goodness-of-fit indices provided evidence for the construct validity of the task interdependence scale.

Nonetheless, this initial examination of the scale's

validity is not enough. Construct validity cannot be determined through a single study. Therefore, efforts to establish construct validity for the task interdependence scale must be continued in future research.

Confirmatory factor analyses were also performed on the remaining measures of the latent variables (i.e., team orientation, initiating structure, consideration, communication, monitoring, feedback, backup behavior, coordination, performance). Construct validity had been established for these existing measures in an earlier study (Rosenstein, 1994). However, as stated previously, construct validity cannot be established through a single study, therefore, the measures listed above were assessed again. The analyses for the measures demonstrated construct validity once again. Each scale displayed moderate to high factor loadings ranging from .70 to .95 (see Table 2).

Measurement models. Measurement models can be utilized to analyze whether measures are distinguishable. Therefore, the hypothesis that task interdependence is a measure separate from other independent teamwork components (e.g., team orientation, initiating structure, consideration) was assessed with the measurement model for independent variables. The factor correlation matrix of this measurement model indicated that task interdependence was indeed a separate construct from team orientation (r = .11), initiating structure (r = .22), and consideration (r = .12).

The correlations among the remaining independent latent variables (i.e., team orientation, initiating structure, and consideration) are higher with one another than task interdependence was with them. However, the correlations did not exceed .74 suggesting that each of these latent variables also attained a separate status. The highest correlation (i.e., .74) was between team orientation and consideration, and this makes sense because both seem to be more concerned with the attitudes and feelings of team members.

Structural model. Another purpose of this study was to examine the relationships among the latent variables in the proposed structural model (see Figure 1). The structural model was analyzed using the subscales that were formed from each measure.

The structural model analysis indicated that four of the five hypotheses were significant: H_2) team orientation → communication, team orientation → monitoring, initiating structure → communication, initiating structure → monitoring; H_3) consideration → communication; H_4) communication → feedback, communication → backup behavior, monitoring → feedback, monitoring → backup behavior; H_5) feedback → coordination, backup behavior → coordination; H_6) coordination is influenced indirectly by the teamwork components; H_7) coordination → performance. Hypothesis number one (i.e. task interdependence → communication),

however, was not found to be significant.

The nonsignificant findings for the task interdependence hypothesis (i.e., H_1), comes as a surprise because communication is inherent in the definition of task interdependence. Mintzberg (1979) states that interdependence is often the reason that teams are initially formed, and other authors feel task interdependence is a defining characteristic of teams (Salas et al., 1992). Therefore, because team members must interact with one another to share information and achieve the team's objective, it would seem that the degree of task interdependence should impact the communication among members.

One reason for the nonsignificance of task interdependence may be due to the particular way task interdependence was measured. All of the data collected were retrospective; thus, the participants may not have given an accurate assessment of team members' task interactions with one another. The participants' average length of time since participating on a team was 2.70 years (see Table 1). Given this length of time, the participants may have been unable to recall the nature of task interdependence.

Another possible reason for the nonsignificant finding between task interdependence and communication may have been that the items in the task interdependence scale were

generically worded. It may be that items measuring task interdependence should be written specifically for member and team tasks. It could be that the nature of interdependence and the success of communication needs to be evaluated for specific work activities.

Alternatively, the nonsignificant finding (i.e., task interdependence → communication) may be due to the communication measure. The items used to measure communication referred to spoken communication (Rosenstein, 1994), whereas many of the teams in this study may have utilized nonspoken communication for exchanging information. This may especially apply to sports teams, which were the majority of teams reported. For example, in baseball, the catcher conveys information to the pitcher by the use of his fingers; in basketball, players extend their arms into the air in order to tell other players that they are open for a shot; in doubles tennis, each player positions him/herself by the position of his/her partner.

In addition to sports teams, work teams may also be communicating in a nonspoken manner due to advancements in technology. Members of work teams may not maintain close physical proximities, and all their interactions may occur via a computer or fax, thereby reducing spoken communication greatly. Future research should specify items that apply to nonspoken communication.

Although the relationship between task interdependence

and communication was nonsignificant, communication had significant indirect effects on coordination and performance as well as significant direct effects on feedback and backup. Communication appears to be the dependent latent variable exerting the greatest degree of influence over other dependent variables in the model. This finding indicates that teams should concentrate on their communication among members in order to improve their effectiveness.

Examination of the matrices of indirect effects also shows partial support for the hypothesis that coordination is indirectly influenced by various teamwork components (i.e., H_5). Coordination appears to be indirectly affected by team orientation and team leadership behaviors (i.e., initiating structure and consideration) (see Appendix G). However, task interdependence was also expected to affect coordination indirectly, but this finding was not significant.

Overall, orientation and initiating structure appear to be the independent latent variables that exert the greatest influence over coordination. Consideration had a comparatively weak effect on coordination. Therefore, it seems that cohesiveness among members and concern with meeting task requirements affects the coordination among members more than the degree of task interdependence and concern for the social and emotional needs of members.

Limitations of the Study and Directions for Future Research

One issue that future research may want to address is measurement technique. Retrospective self-report measures were used to assess participants' team experiences. Future research may utilize a field study whereby particular teams are observed in their natural settings. It would be interesting to see whether or not the observational context provides different direct and indirect effects in the teamwork model.

Future research may also want to consider an experimental technique whereby one defines task interdependence and the nature of communication looking at specific task-related activities. This research should include team tasks that range on the continuum of task interdependence.

The narrow sample used in the research was also a limitation. The sample was chosen solely from a college population. Only 12% of the teams included in the sample were work teams; most of the teams were sports teams (i.e., 48%). Thus, the results found for this study may not be generalized beyond teams found in the college arena. Future research may consider obtaining data solely from individuals employed in organizations. In addition, future research should consider studying only those individuals currently involved in work teams.

Also, specific types of work teams (e.g., nursing

teams, firefighting teams, surgical teams, police teams, military teams) should be studied separately. This may allow one to view differential effects on the relationships among the latent variables depending on the type of team.

One final limitation of this study that needs to be considered was the use of a cross-sectional design to collect data. Future research should utilize a longitudinal study to determine how the latent variables in the structural model change over time.

Practical Implications

Almost twenty years after Naylor and Briggs (1965) addressed the lack of team training research, Dyer (1984) also indicated that we still know very little about what is appropriate in terms of content and the design of team training programs. In spite of its limitations, the current research has practical implications for team training programs.

Because the literature has openly expressed the importance of teams, it is amazing that research has been so inadequate as far as team training principles for the development and implementation of actual team training programs (i.e., tools and procedures). Again, this may be due to the arduous task of studying the extensive characteristics that interact in a team environment (e.g., task characteristics, work characteristics, individual characteristics, team characteristics, environment).

The current research provided information on the important components underlying teamwork and the relationships among these components, which should aid in the identification and understanding of what makes a successful team. This information helps program designers define the content of team training programs (Swezey & Salas, 1992).

Conclusion

Many in the literature note the fact that organizations are increasingly relying on teams (Campion, Medsker, & Higgs, 1993; Dieterly, 1988; Foushee, 1984; Foushee & Helmreich, 1988). Today's dynamic world is full of expanding technology and international competition, where the need for individuals to work together as a team is pertinent for organizational success. Thus, the study of teams is an important area of research. Instruments used to measure teams must be progressively revised and validated in order to ensure an accurate assessment of teamwork processes.

The current research should be viewed as part of a continuing effort to understand teamwork processes and their influence on the effectiveness of teams. It confirmed the construct validity of existing teamwork measures (i.e., team orientation, team leadership, communication, monitoring, feedback, backup behavior, coordination, and performance) (Rosenstein, 1994) and served as the initial step in the

construct validation of a measure of task interdependence.

REFERENCES

American Psychological Association (1994). Publication manual of the American Psychological Association (4th ed.). Washington, DC: Author.

Campion, M.A., Medsker, G.J., & Higgs A.C. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. Personnel Psychology, 46, 823-850.

Cote, J.A., Buckley, M.R., & Best, R.J. (1987). Combining methodologies in the construct validation process: An empirical illustration. The Journal of Psychology, 121, 301-309.

Dailey, R.C. (1980). A path analysis of R&D team coordination and performance. Decision Sciences, 11, 357-369.

Dickinson, T.L., McIntyre, R.M., Ruggeberg, B.J., Yanushefski, A., Hamill, C.S., & Vick, A.L. (1992). A conceptual framework for developing team process measures of decision-making performance (Final Report). Orlando, FL: Naval Training Systems Center, Human Factors Division.

Dieterly, D.L. (1988). Team performance requirements. In S. Gael (Ed.), The job analysis handbook for business, industry, and government (Vol. 1, pp. 486-492). New York: Wiley.

Drasgow, F., & Kanfer, R. (1985). Equivalence of psychological measurement in heterogeneous populations.

Journal of Applied Psychology, 70, 662-680.

Driskell, J.E., & Salas, E. (1992). Collective behavior and team performance. Human Factors, 34, 277-288.

Dyer, J.L. (1984). Team research and team training: A state-of-the-art review. In F.A. Muckler (Ed.), Human factors review: 1984 (pp. 285-323). Santa Monica, CA: Human Factors Society.

Festinger, L. (1950). Informal social communication. Psychological Review, 57, 271-282.

Foushee, H.C. (1984). Dyads and triads at 35,000 feet. American Psychologist, 39, 885-893.

Foushee, H.C., & Helmreich, R.L. (1988). Human factors and aviation. New York: Academic Press.

Guzzo, R.A., & Shea, G.P. (1992). Group performance and intergroup relations in organizations. In M.D. Dunnette & L.M. Hough (Eds.), Handbook of industrial and organizational psychology (2nd ed., Vol. 3, pp. 269-313). Palo Alto, CA: Consulting Psychologists Press.

Hackman, J.R. (1992). Group influences on individuals in organizations. In M.D. Dunnette & L.M. Hough (Eds.), Handbook of industrial and organizational psychology (2nd ed., Vol. 3, pp. 199-267). Palo Alto, CA: Consulting Psychologists Press.

Hall, I. (1988). Teamness index. Woodlands, TX: Telemetrics.

Ilgen, D.R., Fisher, C.D., & Taylor, M.S. (1979).

Consequences of individual feedback on behavior in organizations. Journal of Applied Psychology, 64, 349-371.

Joreskog, K.G., & Sorbom, D. (1993). New features in LISREL 8. Chicago: Scientific Software.

Kiggundu, M.N. (1983). Task interdependence and job design: Test of a theory. Organizational Behavior and Human Performance, 31, 145-172.

Marsh, H.W., Balla, J.R., & McDonald, R.P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. Psychological Bulletin, 103, 391-410.

Mathieu, J.E. (1991). A cross-level nonrecursive model of the antecedents of organizational commitment and satisfaction. Journal of Applied Psychology, 76, 607-618.

Mohr, L.B. (1971). Organizational technology and organizational structure. Administrative Science Quarterly, 16, 444-459.

Mintzberg, H. (1979). The structuring of organizations: A synthesis of the research. Englewood Cliffs, NJ: Prentice-Hall.

Naylor, J.C., & Briggs, G.E. (1965). Team-training effectiveness under various conditions. Journal of Applied Psychology, 49, 223-229.

Pennings, J. (1974, April). Interdependence and complementarity. Paper presented at American Sociological Association Annual Conference, Montreal.

Rosenstein, R. (1994). The teamwork components model: An analysis using structural equation modeling. Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.

Ruggeberg, B.J. (1996). Toward understanding team leadership: The empirical development of a team leadership classification system. Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.

Salas, E., Dickinson, T.L., Converse, S.A., & Tannenbaum, S.I. (1992). Toward an understanding of team performance and training. In R. Swezy and E. Salas (Eds.), Teams: Their training and performance. Norwood, NJ: Ablex.

Smith, H.P. (1979). A simulator study of the interaction of pilot workload with errors, vigilance, and decisions (NASA Report No. TM-78482, NTIS No. N79-14769). Moffett Field, CA: NASA-Ames Research Center.

Swezey, R.W., & Salas, E. (1992). Teams: Their training and performance. Norwood, NJ: Ablex Publishing Corporation.

Thompson, J.D. (1967). Organization in action. Chicago: McGraw-Hill.

Tjosvold, D. (1990). Flight crew collaboration to manage safety risks. Group and Organization Studies, 15, 177-189.

Van De Ven, A.H., Delbecq, A.L., & Koeing, R. (1976). Determinants of coordination modes within organizations.

American Sociological Review, 41, 322-338.

Wagner, H., Hibbits, N., Rosenblatt, R.D., & Salas, R. (1977). Team training and evaluation strategies: State-of-the-art (HumRRO-TR-77-1, AD-A039 505). Alexandria, VA: Human Resources Research Organization.

Wagner, J.A., & Hollenbeck, J.R. (1995). Management of organizational behavior. Englewood Cliffs, NJ: Prentice-Hall.

APPENDIX A

BACKGROUND INFORMATION

Indicate your:

Birthdate: _____

Gender: ___ male ___ female

Length of time as a team member in this specific team:

_____ years _____ months

Total number of members on your team, including yourself:

_____

Use the space below to indicate the type of team to which you belong/ed (e.g., football team, basketball team, decision-making team). Provide a brief description of the major activities of the team.

APPENDIX B

TASK INTERDEPENDENCE AND THE TEAMWORK COMPONENTS' SCALES

Please use the scale below to rate your team. Consider carefully the aspects of teamwork (e.g., TEAM ORIENTATION) and their behaviors (e.g., Cooperate fully with one another). Rate how frequently your team members engage in each of the behaviors.

Almost Never		Sometimes		Almost Always
1	2	3	4	5

TEAM ORIENTATION refers to the attitudes that team members have toward one another and the team task. It reflects acceptance of team norms, level of group cohesiveness, and importance of team membership.

Team members:

1.____ Willingly participate in all relevant aspects of the team.

2.____ Cooperate fully with one another.

3.____ Pull together and place team goals ahead of their personal goals and interests.

4.____ Display a high degree of pride in their duties and the team.

5.____ Display an awareness that they are part of a team and that teamwork is important.

6.____ Assign high priority to team goals.

7.____ Feel that team experience is personally satisfying.

8.____ Feel proud of personal contributions to team output.

9.____ Regard other team members in a positive way.

10.____ Feel close to other team members.

11.____ Do helpful things for other members of the team.

12.____ Unify with other members in pursuit of team goals.

13.____ Feel that accomplishment of team goals is important.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

TEAM LEADERSHIP involves providing direction, structure, and support for other team members. It does not necessarily refer to a single individual with formal authority over others. Team leadership can be shown by several team members.

Team members:

1.____ Encourage other team members to make decisions on their own.

2.____ Work with other members to develop communication methods and areas of responsibility.

3.____ Explain to other team members exactly what is needed from them for a project.

4.____ Review the situation quickly when the team becomes overwhelmed and take action.

5.____ Ensure that other members are working up to capacity.

6.____ Ask other members to follow standard procedures.

7.____ Stress the importance of meeting deadlines.

8.____ Strive to maintain definite performance standards.

9.____ Give consideration to the needs of other members, especially subordinates.

10.____ Provide encouragement when other members attempt to meet new challenges.

11.____ Are willing to listen to problems/complaints of other members.

12.____ Show concern for the welfare of other team members, especially subordinates.

13.____ Strive to create a friendly team environment.

14.____ Provide needed support for new members.

15.____ Listen to the concerns of other team members.

16.____ Assign experienced members to perform critical tasks.

17.____ Assign extra work only to the more capable members.

18.____ Find someone to fill in for them when leaving work.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

TASK INTERDEPENDENCE refers to degree of collaboration (working together) required of members in producing or accomplishing a product or goal.

Team members:

1.____ Cannot perform tasks without information, materials, or assistance from other members on the team.

2.____ Realize their personal work greatly influences the overall outcome of the team.

3.____ Must interact with other members for the accomplishment of the team goal.

4.____ Must understand how their personal work is essential to the work of other team members.

5.____ Can accomplish tasks without interacting with other team members.

6.____ Are clear how much influence they have on other members' activities.

7.____ Use information provided by other team members to perform their job.

8.____ Need input from other team members for the accomplishment of personal goals.

9.____ Can work independently towards the team's objective.

10.____ Have no interaction with other team members.

11.____ Can only perform their individual jobs when other members successfully complete their jobs.

12.____ Are directly affected by at least one other member's performance.

13.____ Must spend a great amount of time providing necessary assistance and information to other members.

14.____ Find it difficult to complete a job on their own.

15.____ Can hinder the performance of other team members.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

COMMUNICATION involves the exchange of information between two or more team members in the prescribed manner and by using proper terminology. Often the purpose of communication is to clarify or acknowledge the receipt of information.

Team members:

1.____ Clarify intentions to other team members.

2.____ Clarify procedures in advance of assignments.

3.____ Pass complete information as prescribed.

4.____ Acknowledge and repeat messages to ensure understanding.

5.____ Communicate with proper terminology and procedures.

6.____ Verify information prior to reporting to others.

7.____ Ask for clarification of performance status when necessary.

8.____ Follow proper communication procedures in passing and receiving information.

9.____ Ensure that members who receive information understand it as it was intended to be understood.

10.____ Communicate information related to the task.

11.____ Discuss task-related problems with others.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

MONITORING refers to observing the activities and performance of other team members. It implies that team members are individually competent and that they may subsequently provide feedback and backup behavior.

Team members:

1.____ Are aware of other team members' performance.

2.____ Are concerned with the performance of team members with whom they interact closely.

3.____ Make sure other team members are performing appropriately.

4.____ Recognize when a team member makes a mistake.

5.____ Recognize when a team member performs correctly.

6.____ Notice the behavior of others.

7.____ Discover errors in the performance of another team member.

8.____ Watch other team members to ensure that they are performing according to guidelines.

9.____ Notice which members are performing their tasks especially well.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

FEEDBACK involves the giving, seeking, and receiving of information among team members. Giving feedback refers to providing information regarding other members' performance. Seeking feedback refers to requesting input or guidance regarding performance. Receiving feedback refers to accepting positive and negative information regarding performance.

Team members:

1.____ Respond to other members' requests for performance information.

2.____ Accept time-saving suggestions offered by other team members.

3.____ Explain terminology to a member who does not understood its meaning.

4.____ Ask the supervisor for input regarding their performance and what needs to be worked on.

5.____ Are corrected on a few mistakes, and incorporate the suggestions into their procedures.

6.____ Use information provided by other members to improve behavior.

7.____ Ask for advice on proper procedures.

8.____ Provide helpful suggestions to other members.

9.____ Provide insightful comments when an assignment does not go as planned.

Almost Never	Sometimes	Almost Always

|---------|---------|---------|---------|
1 2 3 4 5

BACKUP BEHAVIOR involves assisting the performance of other team members. This implies that members have an understanding of other members' tasks. It also implies that team members are willing and able to provide and seek assistance when needed.

Team members:

1.____ Fill in for another member who is unable to perform a task.

2.____ Seek opportunities to aid other team members.

3.____ Help another member correct a mistake.

4.____ Provide assistance to those who need it when specifically asked.

5.____ Step in for another team member who is overburdened.

6.____ Take control of a situation when other team members do not know how to perform.

7.____ Solve a problem posed by another team member.

8.____ Ask for help when needed.

9.____ Maintain their own duties in the process of helping others.

Almost Never		Sometimes		Almost Always
1	2	3	4	5

COORDINATION refers to team members executing their activities in a timely and integrated manner. It implies that the performance of some team members influences the performance of other team members. This may involve an exchange of information that subsequently influences another member's performance.

Team members:

1.____ Complete individual tasks without error, in a timely manner.

2.____ Pass performance-relevant data from one to another in a timely and efficient manner.

3.____ Are familiar with the relevant parts of other members' jobs.

4.____ Facilitate the performance of each other.

5.____ Carry out individual tasks in synchrony.

6.____ Cause other members to work effectively.

7.____ Avoid distractions during critical assignments.

8.____ Carry out individual tasks effectively thereby leading to coordinated team performance.

9.____ Work together with other members to accomplish team goals.

Almost Never		Sometimes		Almost Always
1	2	3	4	5

PERFORMANCE concerns the accomplishment of the activities and tasks required of the team. This team performance occurs with a consideration of the goals and expectations of team members, the supervisor, and the larger organization.

Team members:

1.____ Accomplish team goals.

2.____ Meet or exceed expectations of the team.

3.____ Meet performance goals in a timely manner.

4.____ Regard team output as adequate or acceptable.

5.____ Achieve team goals with few or no errors.

6.____ Produce team output that meets standards of the organization.

7.____ Regard accomplishments of the team to be above average.

8.____ Feel that the team as a whole performed at an acceptable level.

9.____ Met team objectives in an efficient manner.

APPENDIX C

CONFIRMATORY FACTOR ANALYSES

Table C.1

Team Orientation: Maximum Likelihood Factor Loadings, Measurement Error Variance, and Squared Multiple Correlations

	Factor Loadings		
	Team Orientation	Measurement Error Variances	R^2
ITEM1	.52	.36	.43
ITEM2	.51	.41	.39
ITEM3	.63	.53	.43
ITEM4	.59	.49	.42
ITEM5	.64	.36	.54
ITEM6	.67	.38	.54
ITEM7	.68	.51	.48
ITEM8	.38	.39	.27
ITEM9	.49	.45	.35
ITEM10	.60	.71	.33
ITEM11	.50	.60	.30
ITEM12	.60	.37	.49
ITEM13	.54	.36	.45

Note: N=231. Estimates of goodness-of-fit are: chi-square (df=65, p<.05)=329.61, comparative fit index=.80, non-normed fit index=.77. All T-values are statistically significant (p<.05)and greater than 2.0. Items 1, 3, 4, 5, 6, 7, 10, 12, and 13 were retained for the scale.

Table C.2

Team Leadership-Consideration: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	
	Team Leadership-Consideration		R
ITEM1	.30	.87	.09
ITEM9	.81	.35	.65
ITEM10	.70	.43	.53
ITEM11	.86	.37	.67
ITEM12	.79	.27	.70
ITEM13	.65	.29	.59
ITEM14	.68	.46	.50
ITEM15	.72	.30	.63

Note: N=189. Estimates of goodness-of-fit are: chi-square (df=20, p>.05)=76.77, comparative fit index=.95, non-normed fit index=.92. All T-values are statistically significant (p<.05) and greater than 2.0. Items 9, 10, 11, 12, 13, 14, and 15 were retained for the scale.

Table C.3

Team Leadership-Initiating Structure: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error	
Team Leadership-Initiating Structure		Variances	R^2
ITEM2	.53	.54	.35
ITEM3	.54	.45	.39
ITEM4	.56	.52	.38
ITEM5	.62	.47	.45
ITEM6	.62	.60	.39
ITEM7	.69	.66	.42
ITEM8	.43	.47	.28
ITEM16	.52	.56	.32

Note: N=189. Estimates of goodness-of-fit are: chi-square (df=20, $p<.05$)=60.62, comparative fit index=.92, non-normed fit index=.88. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 2, 3, 4, 5, 6, 7, 8, and 16 were retained for the scale.

Table C.4

Task Interdependence: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings		
	Task Interdependence	Measurement Error Variances	R^2
ITEM1	.75	.88	.39
ITEM2	.22	.77	.06
ITEM3	.41	.46	.26
ITEM4	.10	.69	.01
ITEM5	.45	1.39	.13
ITEM6	-.11	.83	.01
ITEM7	.21	.77	.05
ITEM8	.33	1.08	.09
ITEM9	.60	1.36	.21
ITEM10	.32	.76	.12
ITEM11	.81	.78	.46
ITEM12	.79	.59	.51
ITEM13	.46	.99	.17
ITEM14	.73	1.03	.34
ITEM15	.54	.82	.26

Note: N=110. Estimates of goodness-of-fit are: chi-square (df=90, $p<.05$)=453.19, comparative fit index=.56, non-normed fit index=.48. All T-values are statistically significant ($p<.05$) and greater than 2.0, except for items 4 and 6. Items 1, 3, 5, 9, 11, 12, 13, 14 and 15 were retained for the scale.

Table C.5

Communication: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings		
	Communication	Measurement Error Variances	R^2
ITEM1	.60	.31	.53
ITEM2	.66	.54	.44
ITEM3	.63	.38	.51
ITEM4	.56	.53	.37
ITEM5	.50	.52	.33
ITEM6	.57	.53	.38
ITEM7	.47	.74	.23
ITEM8	.65	.48	.47
ITEM9	.70	.39	.55
ITEM10	.60	.34	.52
ITEM11	.50	.58	.30

Note: N=211. Estimates of goodness-of-fit are: chi-square (df=44, $p<.05$)=195.77, approximation=.12, comparative fit index=.85, non-normed fit index=.82. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 8, 9, and 10 were retained for the scale.

Table C.6

Monitoring: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	R^2
	Monitoring		
ITEM1	.44	.31	.39
ITEM2	.43	.48	.28
ITEM3	.56	.56	.36
ITEM4	.50	.47	.34
ITEM5	.45	.51	.29
ITEM6	.40	.36	.30
ITEM7	.41	.56	.23
ITEM8	.47	.72	.24
ITEM9	.46	.55	.27

Note: N=230. Estimates of goodness-of-fit are: chi-square (df=27, $p<.05$)=134.34, comparative fit index=.78, non-normed fit index=.70. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were retained for the scale.

Table C.7

Feedback: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	
	Feedback		R
ITEM1	.55	.49	.38
ITEM2	.66	.50	.47
ITEM3	.51	.45	.36
ITEM4	.58	.65	.34
ITEM5	.52	.43	.38
ITEM6	.64	.42	.49
ITEM7	.60	.43	.45
ITEM8	.55	.42	.42
ITEM9	.53	.61	.32

Note: N=219. Estimates of goodness-of-fit are: chi-square (df=27, $p<.05$)=108.15, comparative fit index=.88, non-normed fit index=.84. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were retained for the scale.

Table C.8

Backup Behavior: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	
	Backup Behavior		R
ITEM1	.58	.78	.30
ITEM2	.64	.45	.47
ITEM3	.59	.36	.49
ITEM4	.43	.28	.40
ITEM5	.77	.70	.46
ITEM6	.57	.64	.34
ITEM7	.62	.44	.47
ITEM8	.48	.61	.28
ITEM9	.47	.32	.41

Note: N=227. Estimates of goodness-of-fit are: chi-square (df=27, $p<.05$)=136.81, comparative fit index=.85, non-normed fit index=.80. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were retained for the scale.

Table C.9

Coordination: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	R^2
	Coordination		
ITEM1	.56	.44	.41
ITEM2	.58	.45	.43
ITEM3	.51	.40	.39
ITEM4	.57	.37	.47
ITEM5	.59	.37	.48
ITEM6	.62	.34	.54
ITEM7	.64	.56	.42
ITEM8	.70	.29	.63
ITEM9	.41	.36	.32

Note: N=215. Estimates of goodness-of-fit are: chi-square (df=27, $p<.05$)=63.34, comparative fit index=.96, non-normed fit index=.94. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were retained for the scale.

Table C.10

Performance: Maximum Likelihood Factor Loadings, Measurement Error Variances, and Squared Multiple Correlations

	Factor Loadings	Measurement Error Variances	R^2
	Performance		
ITEM1	.59	.24	.59
ITEM2	.67	.36	.56
ITEM3	.62	.25	.61
ITEM4	.55	.43	.42
ITEM5	.73	.52	.50
ITEM6	.70	.26	.65
ITEM7	.73	.38	.59
ITEM8	.74	.37	.60
ITEM9	.73	.22	.71

Note: N=227. Estimates of goodness-of-fit are: chi-square (df=27, $p<.05$)=116.22, comparative fit index=.93, non-normed fit index=.91. All T-values are statistically significant ($p<.05$) and greater than 2.0. Items 1, 2, 3, 4, 5, 6, 7, 8, and 9 were retained for the scale.

APPENDIX D

ITEMS USED FOR THE CONSTRUCTION OF SUBSCALES

Team Orientation

Subscale 1: Items 1, 7, 12
Subscale 2: Items 3, 6, 13
Subscale 3: Items 4, 5, 10

Consideration

Subscale 1: Items 11, 13
Subscale 2: Items 9, 14
Subscale 3: Items 10, 12, 15

Initiating Structure

Subscale 1: Items 4, 7, 8
Subscale 2: Items 5, 16
Subscale 3: Items 2, 3, 6

Task Interdependence

Subscale 1: Items 3, 11, 14
Subscale 2: Items 5, 9, 12
Subscale 3: Items 1, 13, 15

Communication

Subscale 1: Items 1, 5, 9
Subscale 2: Items 2, 3, 4
Subscale 3: Items 6, 8, 10

Monitoring

Subscale 1: Items 1, 3, 6
Subscale 2: Items 4, 7, 9
Subscale 3: Items 2, 5, 8

Feedback

Subscale 1: Items 1, 2, 3
Subscale 2: Items 4, 5, 6
Subscale 3: Items 7, 8, 9

Backup Behavior

Subscale 1: Items 1, 4, 5
Subscale 2: Items 2, 6, 9
Subscale 3: Items 3, 7, 8

Coordination

Subscale 1: Items 5, 8, 9
Subscale 2: Items 3, 4, 7
Subscale 3: Items 1, 2, 6

Performance

Subscale 1: Items 4, 5, 8
Subscale 2: Items 1, 6, 9
Subscale 3: Items 2, 3, 7

APPENDIX E

MEANS, STANDARD DEVIATIONS, AND CORRELATIONS FOR THE SUBSCALES

Table E.1

Means, Standard Deviations, and Correlations for Subscales

Subscale	Mean	SD	1	2	3	4	5	6	7	8
1. COM1	4.02	.70	1.00							
2. COM2	3.94	.79	.68	1.00						
3. COM3	3.95	.72	.82	.60	1.00					
4. MON1	4.25	.59	.44	.34	.35	1.00				
5. MON2	4.32	.63	.26	.20	.14	.58	1.00			
6. MON3	4.19	.61	.42	.34	.35	.63	.56	1.00		
7. FEE1	4.02	.74	.56	.49	.53	.46	.25	.44	1.00	
8. FEE2	4.01	.77	.47	.52	.42	.45	.29	.44	.59	1.00
9. FEE3	3.98	.74	.55	.52	.50	.45	.35	.48	.59	.61
10.BCK1	4.19	.76	.42	.33	.34	.33	.23	.30	.35	.30
11.BCK2	4.06	.67	.51	.43	.45	.41	.31	.45	.41	.49
12.BCK3	4.05	.70	.54	.51	.48	.38	.22	.42	.56	.62
13.CRD1	4.12	.68	.60	.54	.54	.34	.30	.45	.47	.53
14.CRD2	4.00	.67	.58	.47	.52	.38	.37	.46	.41	.49
15.CRD3	3.77	.72	.53	.51	.48	.27	.27	.41	.43	.47
16.PRF1	3.97	.78	.48	.41	.46	.25	.15	.33	.35	.34
17.PRF2	4.19	.73	.51	.44	.47	.26	.17	.28	.40	.40
18.PRF3	4.04	.75	.50	.51	.46	.28	.21	.33	.38	.45
19. TO1	4.01	.70	.55	.47	.49	.36	.25	.49	.46	.49
20. TO2	4.08	.76	.45	.39	.34	.29	.26	.44	.36	.44
21. TO3	4.06	.73	.44	.38	.38	.34	.28	.40	.40	.45
22.TLS1	4.02	.72	.45	.52	.44	.36	.26	.36	.47	.49
23.TLS2	4.07	.74	.37	.42	.33	.37	.34	.42	.36	.43
24.TLS3	3.96	.70	.44	.41	.44	.38	.22	.36	.44	.38
25.TLC1	4.02	.89	.55	.44	.46	.32	.13	.36	.45	.42
26.TLC2	3.88	.87	.49	.38	.48	.31	.14	.35	.44	.41
27.TLC3	4.00	.82	.54	.45	.50	.37	.21	.44	.51	.46
28. TI1	3.34	.81	.02	.01	.01	.09	.15	.13	-.04	.00
29. TI2	3.48	.95	.03	.02	.01	.17	.14	.15	-.05	.09
30. TI3	3.28	.85	.12	.09	.11	.29	.30	.29	.13	.19

Table E.1 (continued)

Subscale	9	10	11	12	13	14	15	16	17	18
9. FEE3	1.00									
10.BCK1	.35	1.00								
11.BCK2	.54	.67	1.00							
12.BCK3	.62	.56	.71	1.00						
13.CRD1	.53	.36	.52	.60	1.00					
14.CRD2	.49	.37	.51	.50	.72	1.00				
15.CRD3	.49	.30	.43	.47	.70	.63	1.00			
16.PRF1	.33	.18	.33	.39	.62	.51	.55	1.00		
17.PRF2	.37	.25	.33	.42	.66	.53	.55	.81	1.00	
18.PRF3	.40	.27	.38	.44	.65	.55	.60	.76	.84	1.00
19. TO1	.47	.34	.50	.56	.65	.60	.55	.55	.52	.54
20. TO2	.39	.28	.41	.46	.48	.51	.45	.42	.43	.48
21. TO3	.39	.32	.46	.53	.59	.51	.50	.48	.50	.51
22.TLS1	.37	.28	.41	.46	.47	.34	.38	.39	.41	.47
23.TLS2	.33	.28	.42	.39	.34	.29	.29	.21	.19	.23
24.TLS3	.45	.29	.38	.39	.40	.37	.32	.26	.27	.28
25.TLC1	.43	.36	.45	.53	.51	.46	.41	.42	.38	.38
26.TLC2	.43	.42	.49	.52	.46	.39	.37	.41	.35	.35
27.TLC3	.47	.42	.50	.58	.53	.51	.43	.42	.37	.39
28. TI1	.07	-.01	.02	.08	.06	.05	.02	-.06	-.10	-.10
29. TI2	.01	.01	.04	.03	.07	.02	-.07	.01	-.06	-.04
30. TI3	.14	.14	.23	.20	.12	.13	.09	-.04	-.08	-.07

Subscale	19	20	21	22	23	24	25	26	27	28
19. TO1	1.00									
20. TO2	.69	1.00								
21. TO3	.74	.63	1.00							
22.TLS1	.48	.41	.47	1.00						
23.TLS2	.35	.36	.35	.60	1.00					
24.TLS3	.42	.37	.34	.61	.54	1.00				
25.TLC1	.60	.45	.54	.50	.35	.46	1.00			
26.TLC2	.59	.40	.52	.49	.37	.43	.75	1.00		
27.TLC3	.67	.48	.58	.52	.41	.50	.86	.81	1.00	
28. TI1	.04	.06	.04	.06	.05	.08	.09	.09	.06	1.00
29. TI2	.06	.06	.02	.12	.10	.09	.07	.03	.06	.59
30. TI3	.12	.11	.16	.20	.25	.25	.13	.07	.12	.63

Table E.1 (continued)

Subscale	29	30
29. TI2	1.00	
30. TI3	.55	1.00

Note: N=225. The following abbreviations are used: COM, communication; MON, monitoring; FEE, feedback; BCK, backup behavior; CRD, coordination; PRF, performance; TO, team orientation; TLS, initiating structure; TLC, consideration; TI, task interdependence.

APPENDIX F

MEASUREMENT MODEL ANALYSIS FOR THE DEPENDENT LATENT VARIABLES

Table F.1

Hypothesized Measurement Model for Dependent Latent Variables (Factors)

	Factor Loadings						Measurement Error Variances	R^2
	COM	MON	FEE	BCK	CRD	PRF		
COM1	.66	.00	.00	.00	.00	.00	.05	.89
COM2	.58	.00	.00	.00	.00	.00	.29	.54
COM3	.62	.00	.00	.00	.00	.00	.14	.74
MON1	.00	.47	.00	.00	.00	.00	.12	.64
MON2	.00	.43	.00	.00	.00	.00	.21	.47
MON3	.00	.50	.00	.00	.00	.00	.12	.67
FEE1	.00	.00	.55	.00	.00	.00	.24	.56
FEE2	.00	.00	.59	.00	.00	.00	.24	.59
FEE3	.00	.00	.60	.00	.00	.00	.20	.65
BCK1	.00	.00	.00	.52	.00	.00	.30	.47
BCK2	.00	.00	.00	.56	.00	.00	.13	.71
BCK3	.00	.00	.00	.60	.00	.00	.12	.75
CRD1	.00	.00	.00	.00	.61	.00	.09	.81
CRD2	.00	.00	.00	.00	.54	.00	.16	.64
CRD3	.00	.00	.00	.00	.56	.00	.20	.62
PRF1	.00	.00	.00	.00	.00	.67	.16	.73
PRF2	.00	.00	.00	.00	.00	.68	.07	.88
PRF3	.00	.00	.00	.00	.00	.68	.11	.81

Table F.1 (continued)

	Factor Correlations					
	COM	MON	FEE	BCK	CRD	PRF
COM	1.00					
MON	.51	1.00				
FEE	.74	.70	1.00			
BCK	.66	.57	.80	1.00		
CRD	.73	.56	.74	.70	1.00	
PRF	.60	.37	.55	.48	.78	1.00

Note: N=225. The following abbreviations are used: COM, communication; MON, monitoring; FEE, feedback; BCK, backup behavior; CRD, coordination; and PRF, performance. Estimates of goodness-of-fit are: chi-square (df=120, $p<.05$)=198.55, non-normed fit index=.96, comparative fit index=.97. All T-values for factor loadings, factor correlations, and measurement error variances are statistically significant ($p<.05$), and are greater than 2.0.

APPENDIX G

MEASUREMENT MODEL ANALYSIS FOR THE INDEPENDENT LATENT VARIABLES

Table G.1

Hypothesized Measurement Model for Independent Latent Variables (Factors)

	Factor Loadings				Measurement Error Variances	R^2
	TO	TLS	TLC	TI		
TO1	.64	.00	.00	.00	.08	.84
TO2	.57	.00	.00	.00	.25	.57
TO3	.60	.00	.00	.00	.18	.67
TLS1	.00	.60	.00	.00	.16	.70
TLS2	.00	.52	.00	.00	.27	.50
TLS3	.00	.52	.00	.00	.21	.56
TLC1	.00	.00	.79	.00	.16	.80
TLC2	.00	.00	.73	.00	.22	.71
TLC3	.00	.00	.79	.00	.05	.93
TI1	.00	.00	.00	.65	.23	.64
TI2	.00	.00	.00	.68	.44	.51
TI3	.00	.00	.00	.66	.28	.61

Table G.1 (continued)

	Factor Correlations			
	TO	TLS	TLC	TI
TO	1.00			
TLS	.62	1.00		
TLC	.74	.65	1.00	
TI	.11	.22	.12	1.00

Note: N=225. The following abbreviations are used: TO, team orientation; TLS, team leadership-initiating structure; TLC, team leadership-consideration; and TI task interdependence. Estimates of goodness-of-fit are: chi-square (df=48,p<.05)=58.74, non-normed fit index=.99, comparative fit index=.99. All T-values for factor loadings, factor correlations, and measurement error variances are statistically significant (p<.05) and greater than 2.0, except correlations for TI with TO and TLC.

APPENDIX H

STRUCTURAL MODEL ANALYSIS FOR INDEPENDENT AND DEPENDENT LATENT VARIABLES

Table H.1

Structural Model Analysis

	Lambda Y Factor Loadings						Measurement Error Variances	R^2
	COM	MON	FEE	BCK	CRD	PRF		
COM1	1.00	.00	.00	.00	.00	.00	.08	.83
COM2	.92	.00	.00	.00	.00	.00	.27	.56
COM3	.97	.00	.00	.00	.00	.00	.14	.73
MON1	.00	1.00	.00	.00	.00	.00	.14	.59
MON2	.00	.93	.00	.00	.00	.00	.22	.44
MON3	.00	1.11	.00	.00	.00	.00	.12	.68
FEE1	.00	.00	1.00	.00	.00	.00	.24	.56
FEE2	.00	.00	1.03	.00	.00	.00	.26	.55
FEE3	.00	.00	1.04	.00	.00	.00	.22	.60
BCK1	.00	.00	.00	1.00	.00	.00	.28	.50
BCK2	.00	.00	.00	1.09	.00	.00	.11	.75
BCK3	.00	.00	.00	1.08	.00	.00	.15	.69
CRD1	.00	.00	.00	.00	1.00	.00	.09	.81
CRD2	.00	.00	.00	.00	.87	.00	.16	.64
CRD3	.00	.00	.00	.00	.92	.00	.20	.62
PRF1	.00	.00	.00	.00	.00	1.00	.16	.73
PRF2	.00	.00	.00	.00	.00	1.01	.07	.87
PRF3	.00	.00	.00	.00	.00	1.01	.11	.81

	Lambda X Factor Loadings				Measurement Error Variances	R^2
	TO	TLS	TLC	TI		
TO1	1.00	.00	.00	.00	.08	.85
TO2	.89	.00	.00	.00	.25	.57
TO3	.92	.00	.00	.00	.18	.66
TLS1	.00	1.00	.00	.00	.17	.67
TLS2	.00	.90	.00	.00	.26	.51
TLS3	.00	.90	.00	.00	.21	.71
TLC1	.00	.00	1.00	.00	.16	.93
TLC2	.00	.00	.92	.00	.21	.71
TLC3	.00	.00	1.00	.00	.05	.93
TI1	.00	.00	.00	1.00	.24	.64
TI2	.00	.00	.00	1.05	.44	.51
TI3	.00	.00	.00	1.03	.27	.62

Table H.1 (continued)

Beta (Direct Effects)

	COM	MON	FEE	BCK	CRD	PRF
COM	--	--	--	--	--	--
MON	--	--	--	--	--	--
FEE	.53	.54	--	--	--	--
BCK	.43	.44	--	--	--	--
CRD	--	--	.69	.27	--	--
PRF	--	--	--	--	.84	--

Indirect Effects Among Dependent Latent Variables

	COM	MON	FEE	BCK	CRD	PRF
COM	--	--	--	--	--	--
MON	--	--	--	--	--	--
FEE	--	--	--	--	--	--
BCK	--	--	--	--	--	--
CRD	.48	.49	--	--	--	--
PRF	.40	.41	.58	.23	--	--

Gamma (Direct Effects)

	TO	TLS	TLC	TI
COM	.29	.39	.17	-.08
MON	.25	.31	--	--
FEE	--	--	--	--
BCK	--	--	--	--
CRD	--	--	--	--
PRF	--	--	--	--

Table H.1 (continued)

Indirect Effects of Independent on Dependent Latent Variables

	TO	TLS	TLC	TI
COM	--	--	--	--
MON	--	--	--	--
FEE	.28	.37	.09	-.04
BCK	.23	.30	.07	-.03
CRD	.26	.34	.08	-.04
PRF	.22	.28	.07	-.03

Correlation Matrix Among Latent Variables

	COM	MON	FEE	BCK	CRD	PRF
COM	1.00					
MON	.50	1.00				
FEE	.82	.74	1.00			
BCK	.70	.62	.70	1.00		
CRD	.68	.61	.79	.67	1.00	
PRF	.52	.47	.61	.52	.77	1.00
TO	.66	.60	.66	.56	.55	.42
TLS	.65	.62	.67	.56	.55	.42
TLC	.65	.52	.62	.52	.51	.39
TI	.07	.14	.10	.09	.08	.06

Correlation Matrix Among Latent Variables

	TO	TLS	TLC	TI
TO	1.00			
TLS	.62	1.00		
TLC	.73	.65	1.00	
TI	.12	.24	.12	1.00

Table H.1 (continued)

Psi Matrix

COM	MON	FEE	BCK	CRD	PRF
.18	.11	.05	.12	.13	.18

R^2 For Structural Equations

COM	MON	FEE	BCK	CRD	PRF
.55	.46	.82	.59	.65	.59

Note. N=225. Abbreviations are: TO, team orientation; TLS, initiating structure; TLC, consideration; TI, task interdependence; COM, communication; MON, monitoring; FEE, feedback; BCK, backup behavior; CRD, coordination; PRF, performance. Estimates of goodness-of-fit are: chi-square (df= 386, $p < .05$) = 645.70, non-normed fit index (NNFI) = .94, and comparative fit index (CFI) = .94. For every matrix, all the T-values were greater than 2.0, except for the coefficient between COM and TI and the correlations for TI with TO and TLC.

VITA

Name: Kristin Krahl

Permanent address:

Educational background: The Pennsylvania State University
B.S., Psychology, May 1994
Highest Distinction with Honors
in Psychology