DISSERTATION

TEAM PSYCHOLOGICAL TYPE DIVERSITY, TASK CHARACTERISTICS, AND PERFORMANCE: AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIPS

Submitted by

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School of Education

In partial fulfillment of the requirements

For the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Fall 2005

COLORADO STATE UNIVERSITY

October 19, 2005

WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY NEIL A. KAUFMAN ENTITLED TEAM PSYCHOLOGICAL TYPE DIVERSITY, TASK CHARACTERISTICS, AND PERFORMANCE: AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIPS BE ACCEPTED AS FULFILLING IN PART THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

TEAM PSYCHOLOGICAL TYPE DIVERSITY, TASK CHARACTERISTICS, AND PERFORMANCE: AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIPS

The purpose of this exploratory study was to investigate the relationships between team psychological type composition and perceived performance, and their relevance to team task type, using an associational design. Pearson *r* correlations of individual and team average Myers-Briggs Type Indicator clarity and deviation scores with ratings of team task performance perceptions were developed. These were examined across disjunctive, conjunctive, additive and discretionary team task scenarios, modeled upon Steiner's (1972) team task typology,.

Results showed significant, negative correlations for two of four individual MBTI clarity scores with perceived performance ratings for scenario 2 (conjunctive: success depends on low performer). Individual clarity scores for one MBTI dimension correlated negatively with perceived performance ratings for scenario 1 (disjunctive: success relies on high performer). Individual clarity scores for one MBTI dimension correlated positively with perceived performance ratings for scenario 4 (discretionary: situational combination of individual performance).

Team-level clarity scores for two of four MBTI dimensions correlated positively with perceived team performance ratings for scenario 4. Team average MBTI deviation scores correlated negatively with the average probability of success ratings for scenario 4.

For each of the four task scenarios, individuals rated perceived performance negatively with ratings of task difficulty. In contrast, individuals who rated task difficulty low and interest high tended to perceive that performance would be higher.

Individuals also rated combined performance significantly higher for scenario 3 (additive: total effort of all performers combined) than for scenarios 1 or 2. Other findings included a significant, positive correlation between team average clarity scores and ratings of member desire to continue working with their team.

The conclusions drawn from this research indicate support for a team performance model that includes measures of team composition and task characteristics while considering stakeholder objectives. Implications for team performance theory and practice to benefit managers, trainers, leaders and policy makers suggest further research into these relationships using in-tact teams from a variety of business, industry and institutional settings is advisable. The team performance equation remains a mystery to many. This research added to the body of knowledge and provided a source of clarity for team stakeholders.

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AKNOWLEDGEMENTS

I would like to take this opportunity to express my gratitude to everyone who has supported me throughout my graduate studies at Colorado State University. I am grateful to Hannah and Sarah for sacrificing their time and teaching me the meaning of the word commitment. My most sincere and loving thanks to Erin, without whom this work would never have been completed. Thanks to all my family and friends for their kind assistance and words of encouragement.

I am thankful to my peers and colleagues for their continued support and camaraderie. I would like to express my humble gratitude to my committee, with sincere thanks to Dr. George Morgan for his time and effort in improving and clarifying this study. I would especially like to thank my advisor, Dr. Gary Geroy, for his unwavering support, his deep commitment to his students, and his willingness to invest considerable time and effort towards the successful completion of this work.

I would like to give thanks to all seekers of truth and lovers of knowledge, without whom this life would lack the adventure of inquiry, the joy of scholarship, and the pursuit of wisdom.

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CHAPTER 1: INTRODUCTION

Organizations face significant challenges attempting to stay competitive in the global workplace. International competition, the rapid pace of technological change, outsourcing and employee mobility are just a few of the critical issues confronting organizational leaders and decision makers. To meet these challenges, teams are being utilized to manage the wealth of information and variety of skill interdependencies that characterize the modern world of work.

With the goals of increasing organizational performance and improving the socio-political environment at work, leaders, managers and line employees have embraced the use of formal and informal teams as a preferred strategy to more effectively and efficiently achieve organizational objectives (Guzzo & Dickson, 1996; Thompson, 2000). In response to the changing dynamics of the twenty-first century workplace, social scientists and psychologists have attempted to empirically analyze and articulate theories of individual and team behavior at work. In a society that values and rewards individual performance, the ways in which team performance is currently measured presents new challenges for educators, economists and policy makers. How the theory and practice of individual performance measurement and evaluation applies to team metrics was the focus of this study.

Compelling reasons were presented to seek fresh insight into the nature of team performance. Success in the modern marketplace requires the concerted efforts and talents of varied and interdependent individuals. The social, economic, and political dynamics of competition and cooperation have evolved with the establishment of the postindustrial era (Bell, 1999). Additionally, an ecological ethic of sustainability has

emerged to challenge previously held notions of individual utility and effectiveness (Christensen, 2001). Employing teams in organizations present new challenges and opportunities for shaping the future of performance and productivity measurement.

Critical to this investigation of team processes were the two dynamics of team-member psychological type, (as expressed in individual preferences and measured by the Myers-Briggs Type Indicator [MBTI]), and the perceptions of team members with regard to their performance, relative to the team tasks performed. The focus of this research was to explore the interrelationship of these two dynamics.

Background Discussion to Issues

Teams, as contextualized in the workplace, have multiplied into numerous forms and applications throughout the last century (Sewell, 2001). Recent trends in organizational practice suggest that the use of teams as a means to increase productivity and enhance overall organizational performance has increased dramatically during the past two decades (Guzzo & Dickson, 1996; Oystermen, 2000). During the same period, the definition of an effective and sustainable team has evolved considerably.

Teams in the Workplace

As reported by Thompson (2000), the effective use of teams in organizations has led to increased levels of productivity, performance, and job satisfaction. It has also provided a greater degree of commitment to organizational goals and objectives among team members. Antoszkiewicz (2000) characterizes successful teams as highly integrated, mutually sustained and driven to improve performance and lessen resistance to change. These findings, combined with the fact that high levels of worker turnover is

adversely affecting organizational performance, provide compelling evidence for utilizing and developing teams to increase employee satisfaction and sense of belonging (Reade, 2003; Rousseau, 1998).

There has been an undeniable impact on the contemporary workplace as a result of teams: the development of new communication technologies for sharing information and knowledge (Howard, 2004), the emphasis on culture and value systems to advance organizational goals and objectives (Gannon & Sterling, 2004; Perez, Wen & Mahatanankoon, 2004), and the consistent focus on strategies to improve productivity and reduce turnover (Sorensen, 2000) have led organizations to embrace the use of teams.

Traditional definitions of authority - how work is directed and performed - are giving way to new methods and strategies that focus on worker interdependence. According to Thompson (2000), companies that utilize teams can transform conflict into positive learning and motivational experiences that can lead to improvements in decision-making processes, recognition of the potential of teams to effectively improve individual, group and organizational work environments has become firmly embedded in the theory and practice of twenty-first century organizational performance management.

However, teams also pose some significant problems for the world of work. Teamwork is no guarantee of maximum performance or productivity. Serious challenges exist for organizations that choose to implement team-based performance initiatives. Organizations continue to struggle with the complexities of group dynamics in attempts to create work teams that exhibit high levels of performance. Thompson (2000), in survey results of executives in attendance at the Kellogg Team-Building for Managers Program

(1996-1999), reported that the top concerns of managers regarding team member skills included:

1. Developing and sustaining high motivation
2. Managing conflict productively
3. Providing leadership and direction
4. Fostering creativity and innovation
5. Minimizing confusion and coordination problems

These concerns need to be adequately addressed when planning the design of a work team.

Teamwork

As the twentieth century came to a close the belief in the corporate social contract, which guaranteed job security as a reward for hard work and loyalty, was effectively marginalized. This led many individuals to reconceptualize a job as an opportunity to improve individual knowledge and skill so as to remain competitive in the workplace. Team-based initiatives address the growing trend in worker preferences to belong to a group or culture that extends beyond limited individual experience while aligning with closely held personal values (Rousseau, 1998).

The rewards from teamwork extend beyond the organizational and financial to include the social and psychological benefits inherent in belonging to a team whose members can be trusted and relied upon. The cooperative nature of teamwork provides employees with a satisfying counter balance to the competitive aspects of business. Teams at work offer a unique opportunity to improve the lives of people while improving the bottom line of organizations.

At its core, a functional work team exists to achieve a shared a goal or set of objectives. These objectives by definition cannot otherwise be achieved by individual team members working alone. This interdependence requires team membership to remain bounded or readily identifiable, as well as relatively stable over time. Varying degrees of authority to manage work and internal processes provide teams the opportunity to successfully operate alongside other teams as well as within the larger social context of the organization (Thompson, 2000).

The team performance dynamic continues to be emphasized as one of the most effective methods for the successful execution and completion of work (c.f. West, Hirst & Richter, 2004; Pavel, John & Christopher, 2003; MacBryde & Mendibil, 2003). However, the evaluation criteria for team effectiveness remains a composite of multiple, subjective dimensions. Within this context, Hackman (1987) suggests that team performance be measured along the three dimensions of team productivity, satisfaction, and individual well-being. Thompson (2000) adds a forth dimension, organizational gains, as suggested by Gruenfeld (1998). Based upon the review of literature, the following model of team performance was developed, which will be used to guide the current research

The Three Dimensions of Team Performance

Prior research on teams has focused, in part or whole, on three primary dimensions in attempting to interpret the team performance dynamic. These include,

1. The nature of team tasks
2. The compositional make-up of the team
3. Team stakeholder objectives

Figure 1 illustrates the model for the three dimensions of team performance.

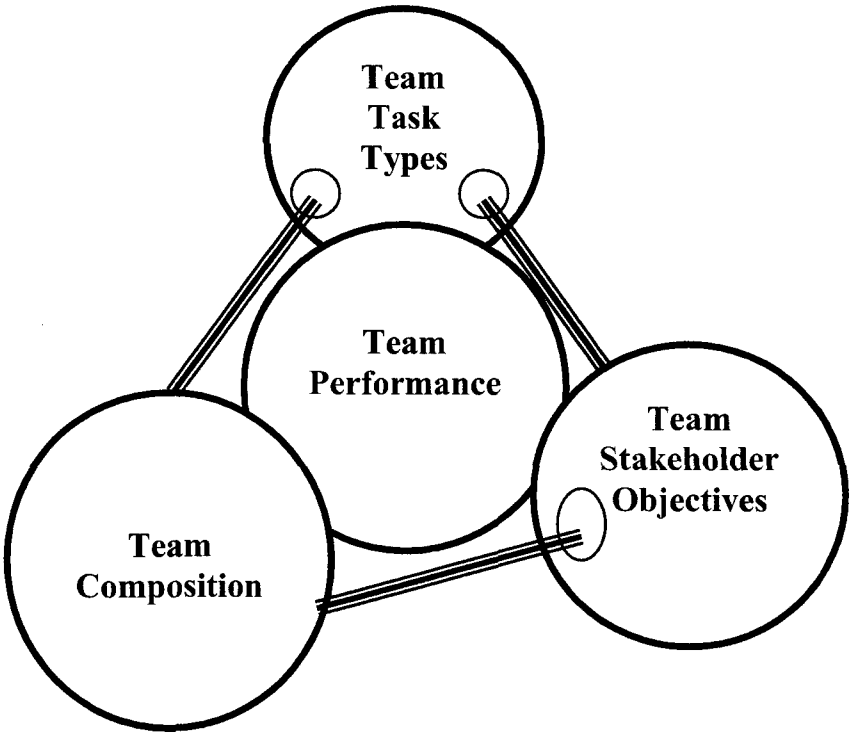

Figure 1. Three dimensions of team performance (Kaufman, 2005)

The Nature of Team Tasks

Teams require concerted effort and coordination in performing and managing work requirements. According to Steiner's (1972) typology of tasks, work assignments may be categorized on the basis of the requirements imposed upon teams that perform them. In simple terms, tasks may be considered divisible or unitary.

Divisible tasks are readily divided into sub-tasks, which may be performed by different team members. This allows for efficient division of labor. An example of a divisible task is the construction of a building, where specialized functions may be allocated to carpenters, masons, plumbers and electricians.

In contrast, unitary task job requirements, such as those performed by data entry clerks, make mutual assistance impractical. Job assignments such as piecework are measured by how much or how quickly, something is performed and is called a maximizing task. Success as a function of approximating a predetermined, ideal outcome is an optimizing task. An example of an optimizing task is the machining of high tolerance part.

Processes as well as available resources that are available may further categorize team task requirements. Steiner's (1972) team task typology distinguishes between: (a) disjunctive tasks in which one member's effort is selected to represent the "best" answer or solution to a problem, where the successful completion of the tasks rely heavily on the performance of one or more performance experts, (b) conjunctive tasks whose success require each member to perform to a minimum standard and where team performance may be limited by a low performing individual (e.g. assembly lines), (c) additive tasks in which success is determined by the sum of all member efforts (e.g. moving a heavy object), and (d) discretionary tasks in which members have the discretion to combine individual contributions in any manner they wish, using a computed average (with or without equal weighting) to arrive at a team outcome (e.g. project schedule forecasting).

Overlap among task types may exist. For example, between a disjunctive task and a specified discretionary task (i.e. one member's input is given full weight, while all others are discounted). Distinctions are due in part to differing process limitations among the four task types. With discretionary tasks, limitations are based upon permissible task strategies. In contrast, disjunctive task strategies are limited by the prescribed strategies employed to complete team tasks (Barrick, et al, 1998; Steiner, 1972).

Team Composition

Individual team members demonstrate a variety of characteristics in the team performance dynamic. A team - a compilation of multiple attributes - has been described by Mohammed, Mathieu & Bartlett (2002) as a mix of individual knowledge, skills, abilities and other factors (KSAOs). Knowledge may be gained through experience and education. Skills develop as a result of environmental factors or through formal or informal training programs. Ability may be considered in both technical and cognitive terms that can be tested through a wide variety of instruments and techniques. "Other factors" may include the psychological and demographic characteristics of the individual team members.

Factors, such as team size, cultural background, environment and psychological characteristics have contributed to considerable team performance research activity (see Bowers, Pharmer, & Salas, 2000). Of particular interest to this study are the psychological dimensions of team composition. A number of studies on team performance have employed the Five-Factor Model (FFM), also called the "Big Five" trait theory approach, to investigate relationships with team psychological composition (see, Barrick, Stewart, Neubert & Mount, 1998; Mohammed & Angell, 2003; Mohammed, et al, 2002; Neuman, Wagner & Christiansen, 1999). The FFM allows for the measurement of an individual's degree of extroversion, conscientiousness, agreeableness, neuroticism and openness to experience through a number of testing instruments. These composition variables are then aggregated to express team measures in attempts to discover or manipulate team performance relationships.

Concurrent with these trends, research and application of Jungian psychology, (first presented in C. G. Jung's book *Psychology Types* [1921/1971]) has experienced explosive growth in the fields of organizational and human resource development. According to Quenk (2000), the Jung/Myers theory includes a dynamic interplay of four different preference dichotomies (Extroversion-Introversion, Sensing-Intuition, Thinking-Feeling, and Judging-Perceiving), which is representative of an individual's psychological type.

Utilization of the Myers-Briggs Type Indicator (MBTI) survey instrument requires forced-choice preferences to be expressed along these four dichotomies. Responses to questions are summed and scored to determine individual preferences within each of the four dichotomies. It is hypothesized that the resulting 16 discrete psychological types, as designated by a four-letter code (e.g., ENFP = extroversion-intuition-feeling-perceiving) encompasses the conscious aspects of an individual's preferences in directing and controlling their endeavors. For any individual, "all 16 types are seen as valid and legitimate ways of being psychologically healthy, adapted, and successful, though their interests, talents, and general outlooks are likely to be quite different." (Quenk, 2000, p.11).

Based upon the Jung/Myers typological model, a considerable body of empirical research has been developed over the last half century that supports the relevancy of the theory in such diverse areas as education, industry, organizational behavior, group dynamics and team development (Bayne, 2004; Quenk, 2000).

There has been much discourse and debate on the strengths and weaknesses of categorizing individuals into specific and, as seen by some, rigidly defined styles and

behaviors associated with psychological typing. The theory exhibits flexibility, however, in explicitly recognizing that a psychological type designation is only one of many ways to measure behavioral similarities and differences in the workplace. Research has found, for example, that similarity or diversity of team member communication styles can affect productivity, conflict, satisfaction and the quality of outcomes (Hammer & Huszczo, 1996). The use of psychological typing in education and industry has allowed for new avenues of exploration within the team composition dynamic.

It is important to note that factors other than psychological type, such as workload, culture and work environment are critical to effective teamwork (c.f. Thaimhain, 2004; Anderson & West, 1998; Johnston & Briggs, 1968). However, there is growing recognition that "more than ever before, analyzing and understanding the experience of work from a psychological perspective is necessary to achieve the twin goals of effective performance and quality of life" (Bayne, 2004, p. xi).

Team Stakeholder Objectives

Of course the specific measures by which team effectiveness is ultimately judged are highly contextual and may vary from team to team and organization to organization. Team stakeholders may include team members, supervisors, clients, or any other individual or entity that has a vested interest in the team's success. Those who are assigned team performance assessment responsibilities (e.g. supervisors, human resource managers, clients, co-workers) add considerably to the variability noted in team performance outcome measurement (Thompson, 2000). Team stakeholder objectives, therefore, help determine the specific team outcome measures to be used as well as the method in which team data is to be aggregated to analyze performance.

Considerable research has stressed the importance of identifying specific team performance outcome measures prior to any reasonable assessment of team effectiveness or success. Examples of outcome-based performance measures include decreased production time and cost (Hackman, 1990), safety improvements and reduced employee turnover and absenteeism (Pearson, 1992) as well as increased profitability (Wall, Kemp, Jackson & Klegg, 1986).

Others recognize the importance of evaluating team processes, noting that these are things teams can directly influence. Specifically, Greenberg and Baron (2000) suggest focusing on diagnostic measures (e.g. average time for project estimation or average cost of new product development, etc.) as indicators of team productivity and performance.

Challenges in team performance measurement include the degree of objectivity / subjectivity operating upon the perceptions and beliefs of the stakeholders of team success. While the context in which team performance is evaluated continues to evolve, research on the perceptions of team members and other team stakeholders with regard to their performance has received only minimal attention.

Method of team data aggregation. A significant problem in team-based performance measurement is the determination of an appropriate unit of analysis. The focus on the team as an entity occurs with the understanding that teams do not perform work; individuals do (Brannick & Prince, 1997). Depending upon the team tasks involved, members of a team may perform work relatively independently, making performance measurement a matter of pooling individual responsibilities. However, in other instances, such as in commercial aviation or hospital surgical teams, members interact in a way that makes decomposition of team performance into individual

accountabilities extremely difficult (Tesluk, Mathieu & Zaccaro, 1997). While data is collected from individual team members, conclusions may only be generalized to the team as a whole to the degree that aggregated individual attributes represent team-level outcomes.

With regard to team task performance effectiveness, Barrick, et al (1998) suggest that operationalization of team composition as a function of member KSAOs may be performed utilizing three different descriptive measures. The first method involves the calculation of a mean score for individual measures, assuming the amount of the individual characteristic possessed by each member increases the collective pool of that characteristic. The second method focuses on the variability of individual characteristics. This is appropriate for understanding the relationship between team composition diversity and team processes and outcomes. The third method focuses on the highest or lowest individual characteristic or attribute of the team; this is used when one member may have a disproportionate effect on team success. Any operationalization of team composition with regard to performance will largely depend on the type of task faced by the team.

Individual Analysis in Understanding Teams

When individual psychological types align with certain jobs or work activities people experience higher degrees of job satisfaction. This phenomenon is consistent with an individual's attitude type (e.g. extroversion / introversion) and mental functions of perception and judgment (Hammer, 1996; Kummerow, 1998). Additionally, evidence suggests that higher levels of job satisfaction are closely related to improved job performance as individuals are drawn to work that they find interesting (Doyle, 2003; Holland, 1996). A question arises, are team psychological type profiles related to team

performance in a way that is consistent with the mechanisms of individual psychological type and job performance?

Psychological type and performance perceptions in the team environment raise additional questions. Does what we believe about individual psychological types influence the relationship between team psychological type profiles and team perceptions of performance? Do psychological type similarities or differences among team members contribute to varying degrees of team performance as perceived by team members? In summary, the issue currently at hand is whether or not team psychological type accounts for some portion of the variability in the perceptions teams hold regarding their performance.

Team Diversity and Performance

Individuals are a composite of many and varied attributes. When individuals are matched or combined into teams, the diversity of individual characteristics, such as skill, ability, experience and psychological type may lead to a variety of possible outcomes with regard to performance. Subsequently, teams that consist of members with highly varied abilities to perform a particular task may or may not express heterogeneity with regard to psychological variables.

A team with more uniform composition characteristics may perform significantly better or worse on a particular task than one with diverse characteristics. Unfortunately, a high degree of uncertainty remains as to whether the team's performance varies due to the distribution of abilities or the distribution of dispositional or behavioral characteristics associated with psychological variables (Brannick & Prince, 1997; Steiner, 1972).

Research has been performed attempting to investigate the relationship between team personality heterogeneity and task performance (Mohammed & Angell, 2003), gender and racial heterogeneity with team performance perceptions (Baugh & Graen, 1997; Karakowsky, McBey & Chuang, 2004) as well as specific team psychological traits and organizational performance (Boone, van Olffen & van Witteloostuijn, 1998). These studies have focused primarily on measurement of team diversity as the presence, absence or specific amount of demographic or personality traits relative to task performance. Noticeably absent from the published literature is research that seeks to investigate the relationship between team psychological type composition diversity and team performance.

These specific mechanisms in organizations; teams, task types, individual team member psychological types, team psychological composition diversity, team stakeholder objectives and expectations, as well as the way in which team-level data is aggregated, provide an introductory view into the complexities of measuring team performance.

Statement of the Problem

The problem for this research was to determine, from a team perspective, whether psychological type is associated with team member perceptions of team performance, relative to team task type, in a college team problem solving and leadership class. The use of the Myers-Briggs Type Indicator (MBTI) provided a unique mechanism for operationalizing the required team psychological type composition variables. We believe the attempt to operationalize the task variable by collecting normally distributed data across the four Steiner (1972) team task types was necessary to inform more fully the

task relationship with regard to team performance. Implications include an enhanced understanding of the team design process, improved intra-team relations and increased organizational productivity gains.

Research Questions

This study will seek answers to the following questions:

1. Is there a relationship between individual team member psychological type and individual team member perception of team performance for each of the four Steiner team task types?
    - 1a. Are individual team member psychological type deviation scores related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?
    - 1b. Are individual team member clarity index scores for the four MBTI dichotomies related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?
2. Is there a relationship between team psychological type diversity and team perception of performance for each of the four Steiner task type scenarios?
    - 2a. Are average team psychological type deviation scores related to average team perceptions of performance for each of the four Steiner task type scenarios?

2b. Are average team MBTI dichotomy clarity index scores related to average team perceptions of performance for each of the four Steiner task type scenarios?

3. Is there a relationship between individual perceptions of team task characteristics and individual member perceptions of team performance?

3a. Are individual team member perceptions of team task interest related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?

3b. Are individual team member perceptions of team task difficulty related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?

3c. Do individual team member perceptions of team performance differ among the four Steiner task type scenarios?

Overview of the Research Process

The model for this study will included discreet, sequential, and significant activities that paralleled the chapters of this document. As suggested by Barth (2003) and Sanders (2003), the research continuum model consisted of the following phases:

Phase 1

The statement of the problem and identification of research questions was enumerated. The purpose of this phase was to identify the issues associated with the content area and pose associated questions. Considerations included why the problem is

important, to whom, and why. Limitations that constrain the research effort and definitions were established.

Phase 2

We include an exploration of the research questions through a thorough and exhaustive literature review. The goal were to determine whether the questions could be satisfactorily answered through the literature review and to generate propositions that could be tested with novel data. We examined whether the existing literature supported the proposition that team member personality type is associated with team member perceptions of team performance relative to team task type. The literature review further explored whether aggregate team personality profiles may be utilized to explain variability in team perceptions of performance. This extensive review of the literature was followed by an analysis to determine the extent to which research questions were answered and whether or not the resulting proposition had merit for testing as a hypothesis. Outcomes from the research literature were considered based upon the following decision matrix:

1. Research questions were satisfactorily answered. These answers were used to formulate propositions which determine:
    a. One or more hypotheses that reflect the propositions' variables and their relationships,
    b. The hypothesis being tested with novel data.
2. Research questions were partially answered:

    Once information, which allowed the research questions to be answered but was absent from the literature review was identified, research using

original data was developed and investigated to confirm the portion of the questions that had been satisfactorily answered, in an attempt to complete the unanswered portion of the question. In this case, information was sought to determine a research design, which will gather additional data to confirm and add to what has been learned from the literature review. This approach was considered necessary when a proposition, which could be put forward for testing as a hypothesis, was not defendable at that juncture.

3. Research questions are not satisfactorily answered in part or whole: Using the literature as a foundational basis, the researcher determined what data is required and began to gather information to formulate a research design to answer the research questions. As this was the result of the literature review, the study was developed based upon these conditions.

Phase 3

The strategy for gathering the appropriate original data to address the outcomes from Phase 2 was formulated. The research design will identify the data gathering method(s) and instrument(s). Included in this section was the design's reliability, validity, and feasibility, as well as the decision rules for addressing unknown and unanticipated problems will be discussed.

Phase 4

Phase 4 included:

1. Analysis of the data derived through the research design, and

2. Interpretation of the research findings.

Phase 5

The meaning and implications of the research outcomes and data were explored. The following questions guided the exploration:

1. What are the implications of the outcomes with regard to the research questions and/or hypotheses?
2. What new or confirmed issues have emerged as a result of the study?
3. What does the study add to the existing body of knowledge or theories?
4. What are the implications for teams, teamwork, and individual team members in organizations?
5. What can be generalized from the study and to whom or what environment?
6. What do the outcomes suggest as possible areas of future study?

Definitions of Terms

The following definitions of terms will aid in the understanding of this study.

Team—a group of people who are interdependent with respect to information, resources, and skills and who seek to combine their efforts to achieve a common goal (Thompson, 2000).

Psychological Type—theory says that each person is an individual, that his or her type is an important element in that individuality, and that our behavior is influenced by our type, but certainly not restricted to it. Further, in its Myers-Briggs Type Indicator theory meaning, the term implies that people are very similar in some respects (nearly everyone uses all the preferences some of the time) but also profoundly and fundamentally different (people are different in kind, not just degree) (Bayne, 2004).

Team Task Type—a determination of a team job requirement activity as being: (a) disjunctive, (b) conjunctive, (c) additive, or (d) discretionary with regard to the processes permitted or prescribed and the resources available (Steiner, 1972).

Team Composition Diversity—is a measure of the variable attributes of a team which deal with member's average scores on these attributes as well as with their dispersion around the averages (Steiner, 1972). For the purposes of this study, *team composition diversity* and *team homogeneity-heterogeneity* will be used interchangeably.

Limitations and Delimitations

This study was predicated on a survey-based, single-case environment of a formal college team problem solving and leadership class. The specific class was selected because of the access provided through the researcher's connection to this academic department and because of the specific team-based nature of the class curriculum. Due to the single-case nature and unique characteristics of the class, the implications of this study have limited generalizability to other environments. There is also the possibility that individuals self-reported in a biased or subjective manner due to environmental circumstances beyond the control of the researcher. An objective questionnaire was used to address this limitation as well as that of potential researcher bias or influence.

Assumptions

An assumption made in this study was that subjects were open and honest in reporting their personality type preferences, as well as their perceptions of their team's performance. In an attempt to support this assumption, the study was designed to ensure confidentiality and anonymity. It is further assumed that the team environment explored in this study had not been significantly altered due to the researcher's inquiry; that the

subjects' preferences and perceptions were characterized by some degree of consistency; and that the subjects had the ability to accurately report their preferences and perceptions.

CHAPTER 2: LITERATURE REVIEW

Teams in Organizations

Guzzo & Dickson (1996) report statistics from the early 1990's on the use of teams in US organizations from a number of sources. The majority of this research (see Applebaum & Blatt, 1994; Lawler, Mohrman & Ledford, 1992; Gordon, 1992) focuses on the interrelation of two areas of investigation; "What makes teams effective, and to what extent do teams as elements in larger social systems contribute to system effectiveness?" (p 331). Estimates were provided from1982 thru 1993 suggesting that in 1990 as many as 47% of large U.S. companies made use of autonomous work teams, with the strongest growth trend occurring between 1987 and 1990. The most frequently cited team-type utilized was the quality-circle-problem-solving team, used at 66% of the Fortune 5000 companies surveyed. Additional estimates showed 80% of organizations with 100 or more employees utilizing teams in some way, with 50% of employees in these organizations belonging to at least one team at work.

In most medium to large-scale organizations there are a number of possible changes that can be made to improve the performance of the firm. However, questions often arise regarding which changes or interventions (and how many) to implement to have the greatest desired impact.

Macy & Izumi (1993) found that the financial performance indicators of organizations show greatest improvement when multiple changes are made in features of organizational structure, human resource management practices and technology. A meta-

analysis of 131 field studies (from 1800 studies investigated) yielded empirical data for 506 effect size measures including financial performance as dependent variables. It was determined that the two organizational changes that had the greatest positive impact on financial performance included the creation of autonomous teams and team development interventions. Team development interventions were also shown to have positive behavioral performance impacts such as reduced absenteeism and turnover.

Based upon the following review of literature, organizations may seek to improve performance through the study of teams and the implementation of team design strategies grounded in empirical research.

Three Dimensions of Team Performance

This survey of prior research on team performance has uncovered a consistent approach within the published literature. Team performance models typically consider one or more sets of contingency-based framework variables within the following three dimensions: team job design (e. g. team task typology), team composition (e.g. knowledge, skills, abilities, personality, demographics) and team stakeholder objectives, which include team performance outcome definition, protocols and measurement. Performance outcome measurement is further categorized by type (e.g. technical-administrative, leadership, contextual) and data aggregation method (e.g. mean, variance, minimum, maximum) for operationalizing team variables (see Mohammed and Angell 2003; Mohammed, Mathieu & Bartlett, 2000; Nueman, Wagner & Christiansen, 1999; Culp & Smith, 2001; Barrick, et al, 1998). The following discussion expands upon these three dimensions through an analysis of a number of recent studies.

Job Design and Team Task Types

Teams are often faced with the challenges of complex tasks that require the development of a variety of strategies to achieve successful task performance. To achieve high performance, teams develop procedures and adapt behavior to the specific requirements of the task. Optimal performance may be determined by the efficiency in which teams deal with critical task elements. For example, high team performance on complex tasks has been shown to be related to the amount and content of communication among team members. Specifically, an increase in the number of messages containing strategy propositions as well as motivational remarks has been linked to improved team performance (Tschan, Semmer, Nagele & Gurtner, 2000).

According to Tschan, et al (2000), tasks can be characterized as simple (or familiar), which are performed by applying general, existing strategies, or as complex, which often require the development of novel, task-specific strategies. Task analysis identifies the goal structure of the task, the operations necessary to attain these goals and the constraints under which task specific activities are to be performed such as time, method and sequence of events. It is recommended that careful, detailed analysis of specific task requirements be undertaken to improve overall team performance.

With reference to teams, Steiner's (1972) typology of tasks categorizes work assignments on the basis of the requirements imposed upon the teams that perform them. In simplest terms, tasks may be considered divisible or unitary. Divisible tasks are readily divided into sub-tasks, which may be performed by different team members, thus allowing for division of labor efficiencies. In contrast, unitary task job requirements make mutual assistance impractical. Also, job assignments that are measured by how much or

how quickly something is performed is called a maximizing task, while success as a function of approximating a predetermined, ideal outcome is called an optimizing task.

The processes permitted and the resources available may further determine team task requirements. As discussed in Chapter 1, Steiner's (1972) four primary task types include: (a) disjunctive tasks, (e.g. the "best" answer or solution to a problem), (b) conjunctive tasks, (e.g. assembly lines), (c) additive tasks, (e.g. moving a heavy object), and (d) discretionary tasks, where members have the discretion to combine individual contributions in any manner they see fit, (e.g. project schedule forecasting).

Overlap among task types may exist, for example, between a disjunctive task and a discretionary task where one member's input is given full weight, while all others are discounted. However, the condition that one process may be permitted while another is prescribed will more often allow for such distinctions (Barrick, Stewart, Neubert & Mount, 1998; Steiner, 1972).

Boone, van Olffen & van Witteloostuijn (1998) performed and experimental study of management team composition and organizational performance. Subjects included 58 management teams throughout Europe competing in a real world management "game". Although no task typology was developed, a thorough description of the problem-solving nature of the work expressed a high level of complexity and team interdependence, thus implying a disjunctive and/or discretionary task structure. However, no relationship between task type and performance was reported in their analysis. Recommendations for future research included analyzing the "actual strategies" (p.70) teams used as a possible mediating variable on team composition and firm performance.

Barrick, et al (1998), in a study of 51 manufacturing facility work teams (N = 652), provide a lengthy discussion of the Steiner task typology described above. While the importance of task type was emphasized, minimal information was provided to help assess the nature of the tasks performed by the teams sampled. The authors do, however provided a general statement to the effect that team processes included primarily additive tasks. Additionally, some unmeasured degree of conjunctive task performance was identified. This study further confounds the task-related performance relationship by stating that certain compositional variables generalize across tasks (e.g. conscientiousness), while others are claimed to be task dependent (e.g. extroversion on disjunctive problem-solving tasks).

Neuman, Wagner and Christiansen (1999) provide insight into work team personality and job performance. Research conducted on 82 teams of retail assistants (N = 328) were assessed on both composition and performance variables. Citing the task framework proposed by Driskell, Hogan & Salas (1988), job analysis was performed, sorting tasks into six categories (mechanical/technical, intellectual/analytic, imaginative/aesthetic, social, manipulative/persuasive, and logical/precision). As a result of the analysis, only three of the six dimensions were found represented in the team task matrix (social, manipulative/persuasive, and logical/precision). This resulted in the development of team outcome measure that drew upon the categorical nature of the tasks. While recognizing the impact of task type on composition and performance variables, the lack of discretely grouped task measures prevents the interaction from becoming fully apparent.

Mohammed, Mathieu & Bartlett (2002), in their study of 25 college student food service / hospitality industry teams ($N = 120$), distinguished between the following two task typology models: Steiner's (1972) typology, which is said to encompass notions of member contribution, and Thompson's (1967, as reported in Mohammed, Mathieu & Bartlett , 2002), viewing tasks in terms of the degree of team member interdependence (pooled, sequential, reciprocal, intensive) required among teams to successfully perform work. Both models complement one another in a number of ways. However, a more detailed investigation supports the notion that the Thompson model is implicitly embedded in Steiner's (1972) model (see also, Tesluk, et al, 1997). It is notable that while the study acknowledged the influence of task type in team performance, it was determined that the team tasks were additive in nature, and therefore were held constant in the research presented.

Mohammed and Angell (2003) provide further research into team composition and performance. In an attempt to address the task-related influences on performance, 59 college business student teams ($N = 267$) working on process improvement projects were evaluated on oral and written team tasks. The associated project deliverables were claimed to be representative of two (socially orientated and cognitively orientated, respectively) of their eight possible job performance dimensions. This represents a more recent trend to categorically manipulate task variables to investigate task influences on team performance (see Day, Arthur, Miyashiro and Edwards, Tubre & Tubre, 2004; Karakowsky, et al, 2004). Citing a number of prior studies, the authors conclude that the nature of the task will strongly affect the team composition and performance relationship.

Of particular literary note is the absence of fully integrating the dimension of task into the team performance model quantitatively. Task type appears to have been relegated to descriptive form, at best a non-parametric grouping variable. An exception is the study by Tschan, Norbert, Nagele & Gurtner (2000) suggesting that the basis for task assessment should go beyond distinctions of simple vs. complex and divisible vs. unitary. The authors hypothesized that performance would be best predicted by task adaptive behaviors (e.g. a complex compilation of behavioral indices representing basic task mastery and handling characteristics) than by general behavior (e.g. amount of communication, number of messages containing strategy propositions, number of messages containing motivational remarks, amount of information sent to supervisor).

Of note is the author's attempt to code behaviors with regard to their associated task relevance through an elaborate process of hierarchical task analysis. While recognizing the inherent rater bias as well as the single task type studied, quantitative indices of task adaptive behaviors were calculated and included into the analysis. The authors conclude, "it is worth the effort to carefully analyze the specific requirements of a given task in much more detail that is typically done" Tschan, et al, (2000, p 383).

A recent experimental study of team performance involved a model that included proxy measures of team task type. Karakowsky, et al, (2004), in a study of 36 randomly assigned college student work teams ($N = 197$) identify male-stereotyped and female-stereotyped tasks. Based upon the perceptions of team members regarding the gender-specific nature of the task being performed, a number of hypotheses around team performance were tested. Significant interactions were found with composition and task type on performance perceptions. Conclusions suggest that a valuable source of

information regarding the nature of the task, including task familiarity, difficulty, and interest, lies with the individuals that are performing them.

Day, et al (2004) contributes to the current research through an experimental study that attempts to manipulate team task along the four dimensions of the Steiner (1972) typology. A total of 157 randomly assigned teams ($N = 596$) were instructed to perform four separate tasks that were specifically designed to reflect the author's conceptualizations of the Steiner model. Mean composition variability (e.g. general cognitive ability) was hypothesized to associate positively with team performance regardless of task type. The authors focused on the appropriate choice of team data aggregation method (e.g. mean, maximum, minimum) for general cognitive ability as it relates to team task performance, the importance of which will be discussed in more detail below.

It has become clear that team performance research should attempt to integrate team task characteristics and variability into the model. Team task type must therefore be considered not only in terms of what is being performed, but, more importantly, under what conditions performance occurs. The idea of creating specific scenarios as a means of operationalizing task-type will be considered to inform the current research. Surveying team members to rate team tasks on a number of task-type levels may allow for stakeholder perceptions to be used to analyze task type variability within situational environments. This would theoretically allow the relationship between composition and task dimensions to be more thoroughly investigated.

Team Composition

An individual may be seen as a unique compilation of knowledge, skill, ability, and personality, as well as a host of other factors. A team may be viewed as a combination of unique individuals. Unfortunately, the complexities and subtleties of team composition, especially with regard to performance, are not well understood (Barrick, et al, 1998, Mohammed and Angell, 2003, et al, Nueman, et al, 1999). This study focused primarily on the psychological aspects of composition. Therefore, demographic composition variables (e.g. race, sex, age) will be further considered only insomuch as they inform the team composition and performance dimensions in psychological terms.

Psychological testing has been utilized in industry and academia as a mechanism for selection and admission for more than half a century (Shultz & Shultz, 2002). Principles of rigorous psychological testing are based upon scientific standardization, objectivity, sound norming, reliability and validity. Psychological measures, such as cognitive ability, interests, aptitudes, motor skills, and personality, have been shown to be relevant to a variety of work related performance issues (Behling, 1998; Bobko, Roth, & Potosky, 1999; Hough & Oswald, 2000; Salgado, 1997).

Team psychological composition variability. Numerous avenues exist for describing, quantifying, and bringing meaning to what constitutes and characterizes an individual's unique personality. Organizational work requirements often involve the combination of, and interactions among, uniquely diverse groups of people. Organizations may benefit considerably through a deeper understanding of psychological diversity and the associated behaviors of team members (Guzzo & Dickson, 1996).

Of the many self-report personality tests available to researchers and human resource managers, those based upon the "Big Five" personality factors (extroversion, agreeableness, conscientiousness, neuroticism, openness to experience) have shown the highest validities (Shultz & Shultz, 2002). The traits of conscientiousness and extraversion have been found to be very effective indicators in predicting job performance in a number of work environments (Caligiuri, 2000; Salgado, 1997). Of particular note, Neuman & Wright (1999) found that the traits of agreeableness and conscientiousness were particularly valid predictors of work-team job performance. Thus investigating the psychological characteristics of individual team members may shed light on the performance related dimensions of team composition.

This is especially true when considering work requirements from a team task perspective. Studies have shown, for example the linking of personality and psychological type with attraction to or attrition from specified professional fields (Culp & Smith, 2001; Thomas, Benne, Marr, Thomas & Hume, 2000). A profession may be viewed as inclusive of certain tasks that are unique and specific to the type of work performed. A carpenter, for example, is required to perform highly specified tasks (e.g. checking dimensions, cutting wood, fastening bolts) in unique environments (e.g. construction sites). A given team member may be attracted to certain professional tasks in varying ways, which can be measured using psychological testing. By understanding the nature of the task, a more complete picture of personality and psychological type may be informative in the team member selection process.

Team psychological composition and performance. Guzzo & Dickson (1996) cite cohesiveness, composition and performance, leadership, motivation, and group goals as

the generic, team-related issues most actively researched in the 1990's. While not the only research topics related to team performance, these were found to be relevant to virtually all teams, regardless of the type of work being performed. The author's survey of late twentieth-century research on the performance of teams in organizations looked at team composition by investigating the nature and attributes of team members. Typical research models include team composition as one of a number of possible design variables (e.g. type, size, diversity) that are related to assessments of performance over time of existing teams in organizations.

Boone, et al (1998) utilized a single personality trait (locus of control) to experimentally test a hypothesis on team diversity and organizational performance. Using a forced-choice, 29-item instrument, individual team members were determined to possess either an internal (active agent) or external (passive agent) locus of control orientation. Teams were assembled representing three grouping levels, reflecting primarily internal, external, and mixed compositions. Team performance was determined to differ significantly on a number of indicators as a function of team composition for the locus of control variable.

In the Barrick, et al (1998) study, the compositional variables selected include two categories; ability (general mental ability, or GMA, from the Wonderlic Personnel Test) and personality (five factor model (FFM) derived Personal Characteristics Inventory). Additionally, social cohesiveness (an aggregate of measures including conflict, member flexibility, team communication, and workload sharing) was included as an intragroup process variable through which team composition and effectiveness were related. Their research suggests team process may emerge as a potential novel inclusion into the team

performance dimension model. However, due to significant correlations noted between levels of social cohesiveness and the FFM personality indices, coupled with a lack of additional studies that consider process variables as separate from compositional variables, process variables will be considered as part of the KSAOs "other factors" category of team composition in this study.

The Neuman, Wagner and Christiansen (1999) study reported two primary measures of team composition: team personality elevation (TPE) and team personality diversity (TPD). Using the FFM derived Personal Audit (PA) and the California Psychological Inventory (CPI), TPE was calculated as the team mean of members on a given personality construct or trait level. TPD was calculated as the variance (e.g. standard deviation) among team members on a given personality construct or trait level. This research found TPE levels (conscientiousness, agreeableness and openness to experience) and TPD levels (extroversion, emotional stability) associate significantly with team performance. Their categorization of composition variables supports the theory that the team data aggregation method may play a pivotal role in expressing the relationship between team composition and performance.

Mohammed, Mathieu & Bartlett (2002) view team composition as a broad term referring to a myriad of possible configurations of members with diverse backgrounds and characteristics. The authors suggest that team composition, further divided into team-related (team work experience, extroversion, agreeableness and neuroticism), and task-related (academic ability, work experience and conscientiousness) composition variables strongly influence team outcomes. Their research supports the conclusion that team performance measures are related to composition variables such as academic ability, task

experience, teamwork experience and four of the "Big Five" personality traits (Mohammed, Mathieu & Bartlett, 2002).

Mohammed and Angell (2003) provided a contingency framework based upon specific team knowledge, skills, abilities and other factors (KSAOs) including the five factor (NEO-FFI) personality dimensions. An additional composition variable (team orientation) was operationalized using a twenty-one item, five-point Likert scaled instrument. This was used to test a number of composition-related hypotheses. However, the discussion of performance outcome measures below identifies problems related to claims of hypothesis support within their study.

Other composition variables, such as general cognitive ability, have been shown to relate to team performance. In Day, et al (2004), predictions of a positive relationship between mean cognitive ability of the team and team performance were supported regardless of task type. The authors conclude that general cognitive ability correlates strongly with team task performance, while suggesting that personality would play a greater role in long term team viability.

The composition variability expressed in teams appears to be exceeded only by the diverse means in which team composition is operationalized.

Composition diversity in teams. Of particular interest to this research is the variable of team diversity, which, for said purposes will be synonymous with within-group heterogeneity. According to Guzzo & Dickson (1996), "diversity refers to dissimilarity among members in terms of gender, ethnicity, race, personality, culture, and functional experience, among other things" (p 331). Of particular note is the author's

statement that "there is a real need to develop theory and data on the ways in which dissimilarity among members contributes to task performance" (p 331).

Guzzo & Dickson (1996) cite a number of studies attempting to relate team performance to diversity variables such as team size and member background (Campion, Medsker & Higgs, 1993), team size and type of member job held (Magjuka & Baldwin, 1991), functional expertise (Jackson, Brett, Sessa, Cooper, Julin & Peyronnin, 1991), as well as cultural differences (Watson, 1993). Relationships were investigated with a number of dependent effectiveness outcomes such as creativity, decision-making, organizational innovations and turnover, to name a few.

The Boone, et al (1998) study invokes the notion of "requisite variety" (p. 52), which implies that within-team diversity should be matched with a more complex, non-routine decision environment for optimum team performance. Diverse teams may benefit from the wide range of team KSAOs, arriving at appropriate solutions as each member provides only part of the diversity needed to solve the problem. Conversely, for simple or routine decision environments, requisite variety implies that diverse teams may be a waste of resources. Thus diversity benefits may only be significant in complex team environments, with process losses (e.g. communication, conflict, turnover) dominating in relatively stable environments.

Neuman, Wagner and Christiansen (1999) concurred, explaining the research challenges of relating team compositional diversity to performance: "It has been suggested that the compatibility of the members in groups is a function of both similar and diverse traits. Thus certain traits may enhance performance when the team is homogeneous, whereas other traits may enhance performance when the team is diverse"

(p 32). The authors suggest that measuring team personality diversity across traits might obscure potentially significant relationship between individual traits and performance.

Harrison, Price, Gavin & Florey (2000) make an important contribution to the literature by identifying potential time-related mediating and moderating effects of composition diversity on team performance. Their model of team diversity considers the construct as including surface level (age, ethnicity, gender) and deep-level (personality, values, attitudes) components, which are thought to have varying influence on performance relative to how long the team has been working together. The research supports a position that surface-level diversity influences have considerably stronger effects on performance early in the team's experience. It is hypothesized that these surface-level influences subsequently decreases over time.

Conversely, deep-level diversity measures may express significant relationships with team performance only after considerably more time has been spent interacting within the team. The authors propose that the degree of team collaboration over time plays a critical role in neutralizing surface level and enhancing deep-level diversity effects. They note the potential for time-related Type I & II errors may be distributed unevenly over the life of the team. For example, psychological variables, such as a preference for extroversion / introversion behaviors may require sufficient team interaction time before emerging as significant factors relating to performance. Caution is recommended here, particularly for longitudinal team performance studies (Harrison, Price, Gavin & Florey 2000).

In Karakowsky, et al. (2004), team composition diversity and performance research focused on a demographic variable (gender) and its relationship with team

performance. Male-dominated, female-dominated, and gender-balanced teams were hypothesized to perform differently on male-orientated and female-orientated tasks. An interaction was predicted based upon the team's perception of the gender-stereotypical nature of the task. Their research presented evidence of the existence of "perceptual" as well as "actual" approaches to team performance variable measurement and assessment.

Psychological type and the Myers-Briggs Type Indicator. Considering that an assortment of possible perceptual issues may be at work at a number of organizational levels, the effect of team composition diversity on performance remains a complicated subject. One of the more popular methods for operationalizing psychological dimensions of composition diversity involves individual reports of preferences on a number of bi-polar choice alternatives (Bayne, 2004; Bolton & Bolton; Quenk, 2000). The theory of psychological type differs significantly from the trait theory based Five Factor Model. The former acknowledges the existence of a set of varying psychological characteristics, while the latter expresses a quantitative amount or degree of a given trait as being present or absent in the individual (Quenk, 2000).

Of particular interest to this study is the Myers-Briggs Type Indicator (MBTI) psychological type instrument developed by Isabel Myers and Katherine Briggs (Myers and McCaulley, 1990). Building upon the work of the noted psychiatrist C. G. Jung (1921/1971), Myers and Briggs developed a scientifically rigorous and reliable psychological instrument for measuring individual preferences using the following four dichotomies:

1. Extroversion and introversion: Where an individual prefers to focus his/her attention and get energy.

2. Sensing and intuition: The way an individual prefers to take in information

3. Thinking and feeling: The way an individual prefers to make decisions.

4. Judging and perceiving: The way an individual orients himself/herself to the external world (Culp & Smith, 2001, p 25).

Psychological type and trait are two different things. Therefore the MBTI differs from trait approaches to personality (e.g. Five Factor Model). For each team member, the MBTI identifies one of two opposite personality type categories representing each of the four complex domains of psychological functioning. Alternately, trait approaches typically measure variation along a continuum. For example, extroversion type in the MBTI represents an individual's preference, confidence and comfort using extroversion over introversion in their orientation to the outside world. In contrast, the extroversion trait in the FFM is a score that measures the amount or deficit of the extroversion characteristic (Myers, McCaulley, Quenk & Hammer, 1998).

> "According to Jung's theory, everyone has a natural preference for one of the two poles on each of the four preference scales. A person may use both poles at different times, but not both at once and not with equal confidence. There is one pole that a person prefers, and when using it, the person generally feels most at ease, competent, and energetic" (Culp & Smith, 2001, p 25).

Utilizing the MBTI, Culp & Smith (2001) compared specific professional groups (e.g. engineering team members, insurance agents, management consultants and human-resource personnel) with the general population. The study was performed to illustrate potential type differences in functional work groups based upon professional area of expertise. Most notably was the conclusion that certain psychological types appear to gravitate towards specific professions. Similar findings were reported by Thomas, et al. (2000).

Numerous other psychological testing instruments exist and are in wide practice. Within the team performance literature, those that focus on the Five-Factor Model of personality appear most prevalent. However, the use of the MBTI appears most appropriate to the current study based in part upon the attractiveness of the theory with regard to individual preferences. A more compelling reason is the reliability and flexibility of the instrument; it allowed for operationalizing team composition diversity in a novel way. This will be discussed further in Chapter 3.

Team Stakeholder Objectives

In the workplace, internal or external team constituents may assess team performance. Team members may be required to rate the performance of other team members or the team as a unit. Managers or executives may be asked to rate team performance relative to individual members, the team as a whole, or as higher-level business objectives such as overall organizational performance (see Mohammed, Mathieu & Bartlett, 2002). The multitude of measurement levels and contexts, coupled with a dearth of research in this field, have lead to a patchwork of contingency-based team performance outcome measures in the literature. Performance outcome measures vary widely from study to study, based in part upon the job design and contextual framework of the research.

Within the organizational context, team effectiveness may be operationalized in a number of ways including performance outcome measures and intragroup or interpersonal process events. According to Guzzo & Dickson (1996), when measuring team performance effectiveness, metrics may be applied at three levels: the individual team member, the team, and the organization (e.g. where a team may be included as part

of an overall change strategy). Each may be seen as contributing to three notions of team performance measurement: productivity (e.g. unit of output), interdependence (i.e. management of the consequences of group work), and the sustainability (viability) of long-term team success (Hackman, 1990; Thompson, 2000).

Team performance outcome measurement. Outcome measures in Boone, et al (1998) included two organization-level performance indicators (firm market share, return on equity). The experiment manipulated the locus of control trait resulting in three team types, including predominantly internal, external and mixed teams on the locus of control variable. By introducing an environmental dynamism variable (industry) to the analysis, team type differences were assessed using analysis of variance. Significant main effects of team type (locus of control) on performance measures were discovered along with a significant interaction effect of team type by industry dynamism on performance. The results suggest that, overall, systematic diversity differences appear to affect average team performance based upon the complexity of the work environment.

In Barrick, et al (1998), an investigation of a variety of proposed performance outcome measures aligned with two central themes of team viability (supervisor ratings of team's capability to sustain itself over time, as well as team member ratings of willingness to continue functioning as a team) and team performance (8 dimensions including knowledge of tasks, quality of work, quantity of work, initiative, interpersonal skills, planning and allocation, commitment to team, and overall evaluation of team performance).

Significant, positive correlations were discovered that related general mental ability (GMA), extroversion and emotional stability to team viability and team

performance respectively (r = .23 - .32, p < .05). Additionally, conscientiousness and agreeableness were found to correlate significantly with team performance. The team variance of conscientiousness correlated negatively with team performance (r = -.33, p < .05), suggesting similarity of this trait among team members may positively influence the team under certain circumstances (Barrick, et al, 1998).

In Neuman, Wagner and Christiansen (1999) two performance measures were considered as representing team effectiveness. First, rating of customer service was determined by external team stakeholders (e.g. human resource personnel) as a function of the number of customer complaints recorded for each team over a one-month period. A second outcome, rating of task completion, was determined by internal team stakeholders (e.g. team supervisors) based upon the number of days the team completed work on time over a one-month period.

An index of overall team performance was developed using a standardized composite of the two measures. As noted earlier, a number of composition variables correlated significantly with team performance. Their results, however, may reflect a number of potential design shortcomings, including the validity of the outcome measures assessed, the short-term duration of data collection, and the absence of applied task-type measurement (Neuman, et al, 1999).

Mohammed, Mathieu & Bartlett (2002) operationalize performance outcomes utilizing three primary variables from both internal and external team stakeholders. These included technical administrative task performance (instructor rating of team's postproduction reports), leadership task performance (instructor rating of team's management performance) and contextual performance (team peer rating on aspects of

volunteering, cooperating, initiative and enthusiasm). The authors conclude "different predictors emerged for each type of performance, which emphasizes that differences in task type reflect a major source for variation across teams and that a single composition for work teams does not exist" (p. 810-811). This conclusion, while supported in various other cited sources, is puzzling in light of the fact that only one task type (additive) was considered.

Mohammed and Angell (2003) utilized external stakeholder ratings of social and cognitive tasks as their framework for measuring oral performance (oral presentation evaluations from instructor, project sponsor, classmates and special guests) and written performance (report writing evaluations from instructor). Citing task-type differences as reflecting a major source of variation among teams, the authors suggest that team task type and team context are critical factors in team design and performance outcome assessment.

However, a detailed analysis of the author's research discovered all claims to significant relationships between composition and performance were based upon a single correlation between cognitive ability (measured as student self-report of GPA) and written performance (instructor evaluated) ($r = .35, p < .01$). Additionally, the strongest relationship found in their model was between GPA and class type ($r = .63, p < .01$), suggesting cognitive ability stratified along unreported class type demographic dimensions. The authors performed a hierarchical regression analysis based upon the efficacy of the GPA-performance effect. This led to claims of support for a number of their hypotheses, including the relationship between cognitive ability and performance. Study-wide, "overall, moderate support was found for the hypotheses" (Mohammed and

Angell, 2003, p. 670). Their research contributes to the evolving team performance theory by recognizing the dynamic interplay of many of the four dimensions.

Day, et al (2004) operationalized team performance along the four Steiner (1972) dimensions. Additive team task performance was scored as a function of the sum of the total number of correctly solved problems from each member. Compensatory (i.e. discretionary) team task performance was determined as the absolute difference in importance rankings between the team and a panel of experts on proposed requirements for a hypothetical survival situation. Disjunctive team task performance was scored on a set of problems containing objectively correct answers. Teams were encouraged to interact; however, members were also instructed to work on individual items together and to arrive at a solution before progressing to other items. Finally, conjunctive team task performance was considered successful only if all members satisfactorily completed their parts. The author's experimental model improves somewhat upon the clarity of the task type effect cited in much of the team performance literature.

Karakowsky, et al, (2004) measured performance on two separate tasks (male and female-orientated). Perceptions of team performance were considered relevant in light of the dual nature of the tasks that were performed. All team members completed performance evaluations for each of the two tasks. These were used to assess the influence of gender numerical status and gender-orientated tasks on the perceptions of team performance. While no link to actual performance was hypothesized, performance perceptions as a function of task orientation varied significantly on the composition variable (gender). Here the team's perception of performance appears related to the concurrent perceptions of the type of task performed.

Actual team performance was determined by external stakeholders (judges) using a measure that was analogous to the team's self report survey. However, the judges found no significant differences in performance among all teams and between both tasks. Therefore, the authors dismiss differences in actual team performance and team performance perceptions, "given that they have no basis in reality" (Karakowsky, et al, 2004, p 516). Of course, the author's conclusions rest upon the fact that their teams were assembled and asked to perform together within a 30 minute interval. Thus the potential value of team perceptions of performance for in-tact work teams, particularly in regard to perceptions of task type, may have been prematurely dismissed.

Perceptions of team performance. Humans notice order and patterns in their work and their lives. The process by which individuals select, organize and interpret information relative to work outcomes informs the process of individual performance perception (Greenberg & Baron, 2000). Team performance may be considered in terms of team member perceptions of the performance measure under consideration. It follows that the validity of the performance measure under study may be considered directly related to the degree that it objectively and demonstrably satisfies the conditions of the successful completion of job tasks.

Objectivity, however, is at a premium with regard to how team outcomes are perceived. As noted earlier, performance variables may be interpreted at individual, team and organizational levels. Additionally, performance perceptions may include those of peers (team or other), team supervisors, other organizational members (e.g. human resource personnel), as well as outside constituents (e.g. clients). Regardless of the source

of performance ratings, the influence of perceptual or preference biases of each individual rater must be considered (Karakowsky, et al, 2004; Neuman, et al 1999).

Performance perceptions are useful to the extent that they can be related to some objective or valid criterion of job performance. In the workplace, ratings of employee performance by direct supervisors are most often used in the establishment of the criterion related validity of performance measurement (Shultz & Shultz, 2002). Of course, without detailed, specific and measurable job design (i.e. task) metrics, supervisor ratings may suffer from inherent bias. Worker performance ratings may reflect rater perceptions as well as actual, verifiable outcomes (Greenberg & Baron, 2000).

When perceptions of performance correlate highly with actual performance measures, this may be considered an indication that job tasks and performance measures are well aligned. Thus the perceptions of team members, with regard to both team performance and team task types were of particular interest to the this research.

Team data aggregation methodology. An organizational assessment of effective team performance should include a consideration of individual as well as collective contributions (Tesluk, et al, 1997). Typically, team performance variables are quantitatively measured through a scoring, rating or ranking matrix that is indexed to a predetermined set of standards. The lack of proven team metrics that address performance at the team level often leads to a process whereby individual team member performance measures are aggregated to determine team-level outcomes (Barrick, et al, 1998; Bowers, et al, 2000).

Data aggregation in the majority of the quantitative studies surveyed expressed a clear pattern of operationalizations through four descriptive statistical measures (mean,

standard deviation, maximum and minimum). Continuous team level metrics were derived from these descriptive measures for the team composition and performance outcome dimensions. Subsequent statistical manipulation of the data follows in an attempt to discover significant relationships or grouping differences among the variables. The contingency approach is prevalent in the literature as each individual study deviates along its own contrived methodology, delving into the contextual parameters of the three dimensions of the team performance model presented earlier in Chapter 1. The overwhelming majority of studies investigated consistently recognize the lack of sufficient quantitative research in this area as well as the need for development of standard metrics. (e.g., Barrick, et al, 1998; Mohammed and Angell, 2003; Neuman, et al, (1999).

Mohammed and Angell (2003) provide an insightful discussion of the aggregation issues currently challenging team performance research. Two polar emergence models are presented which bind the framework for explaining how individual phenomena combine to form team phenomena. Isomorphic compositions are said to have team-level properties essentially the same as the individual members. In contrast, discontinuous compilation holds that team properties are a complex assemblage of diverse individual members.

Isomorphism is said to be the dominant approach in the prior research literature. Studies utilizing this framework typically operationalize team variables using the mean as a representation of the team outcome measure being studied. However, discontinuism is an emerging approach that appears to show that the variance of individual member

contribution is a more consistent team outcome indicator with regard to team composition (Mohammed and Angell, 2003, Barrick, et al 1998).

Barrick, et al (1998) suggests that team composition be operationalized using one of three methods. Assuming that team member KSAOs increase the collective team KSOA pool (e.g. additive tasks), calculation of the team mean on a given performance measure is the most common method. When research seeks to investigate the relationship of team composition diversity and performance, focus on the variation of member KSAOs is more appropriate as it may capture the differences that are often masked by averages. Finally, where one member has an inordinate effect on team outcomes (e.g. disjunctive and conjunctive tasks) focus on the maximum or minimum score may lead to the most relevant performance information required.

The team performance investigation by Barrick, et al (1998) operationalized all process and performance variables using 5-point Likert-type scales. Recognizing the importance of the type of aggregation method utilized, the authors report means, variances, maximums and minimums for all variables, which are included in four complementary levels of correlational analysis. However, while performance variables correlated significantly with a number and variety of General Mental Ability (GMA) and personality aggregates, no relationship across aggregation methods was hypothesized or reported.

Neuman, Wagner and Christiansen (1999) operationalized composition variables using mean team personality elevation (TPE) and the standard deviation team personality diversity (TPD). The performance outcome measures discussed earlier were developed using a five-point Likert-type scale. Correlational analysis of the TPE and TPD

compositional components revealed significant, positive, medium effect size relationships, including team performance with levels of TPE ($r = .31 - .41$, $p < .01$) and TPD ($r = .23 - .26$, $p < .05$). Of particular note, four of the "Big-Five" traits (agreeableness, conscientiousness, extraversion, openness to experience) expressed significant negative correlations between their TPE and TPD dimensions ($r = -.25$ to $-.39$, $p < .05$). This was not reported by the authors and may suggest that a significant inverse relationship exists between TPE and TPD (i.e. as the team average for a given personality trait increases, the variability of the trait within teams decreases). Certainly, this must be true in the extreme case (e.g. mean score = maximum or minimum possible score). However, as this would not be obvious to all researchers or practitioners, some discussion of the implications of this relationship should have been provided.

In the Mohammed, Mathieu & Bartlett (2002) study, all composition and performance measures were based on additive tasks and were therefore aggregated through the mean. One of the potential weaknesses of this study is that data was collected at two intervals during a sixteen-week period. Time of data collection corresponded with work assignments that were scheduled during different weeks for all teams. While some teams were assessed earlier, while others were measured later, thus invoking the potential for the time-related measurement errors discussed earlier (see Harrison, et al, 2000).

Mohammed and Angell (2003) utilize means and standard deviations to aggregate team composition and performance variables. While no significant relationships were found to exist between team personality heterogeneity and team performance, other unreported data findings were noted with regard to aggregation. These will be discussed in more detail below.

Two of the studies reviewed included experimental design approaches that tested for significant composition differences upon performance variables (Boone, et al, 1998; Karakowsky, et al, 2004). The composition variables considered in each study were dissimilar (locus of control, and gender, respectively); however, both studies choose to manipulate composition categorically, at three grouping levels, utilizing proportional representation. Variations in team composition diversity (internals, externals and mixed for locus of control; male-dominated, female dominated, and balanced for gender) were tested on a number of performance outcome measures. Composition variability continues to be investigated as an independent predictor of team performance. However, utilization of categorical data for composition and task limit the statistical power of these experiments. .

A third experimental study by Day, et al (2004) aggregates a team composition variable (e.g. general cognitive ability) using the mean, minimum, and maximum. This study specifically hypothesized that mean level of general cognitive ability would significantly predict team performance to a greater degree than minimum and maximum scores, regardless of the team performance measure applied. Results of the correlational analysis show support for their hypotheses. Significant relationships were found between general cognitive ability and all three aggregates of the dependent performance measures.

A number of notable considerations emerged with regard to data aggregation. First, the lack of clear agreement or consistent application of task typology in the studies cited has led to varying approaches to data aggregation methods. Second, arguments over statistical operationalizations of group characteristics suffer from a number of assumptions. While using averages to represent team characteristics where team member

counts average 4-6 individuals, the application of any inferential statistic becomes suspect with regard to norming team attributes. The resulting lack of statistical power at the team level weakens assumptions of normality with regard to the distribution of team characteristics. This may be especially salient for team designs based upon personality dimensions where, for example, two teams may express similar average and standard deviation measures on one characteristic but are still considered compositionally diverse on others.

Team Design Considerations

The study of the purposeful design and configuration of teams in the workplace has exposed significant gaps in the research literature. A number of prospective models exist for further investigation of the dimensions of team performance. For a thorough assessment of effective team performance, prior studies recognized, in part or whole, the importance of team task, composition, and stakeholder objectives, including specific outcome measures and methods for aggregating individual member contributions. However, no single model or methodology has been forwarded that satisfactorily addresses each of the three dimensions discussed in detail above.

Task dimensions have been explored at the categorical level in much of the literature surveyed, with no studies investigating team task variability as an independent measure. Interestingly, much of the research surveyed supports the claim that team task assessment is a critical component of team design (i.e. composition) and performance evaluation. Steiner's (1972) task typology model was represented in five of the studies reviewed and has emerged as one of the few "consistent" constructs in the team performance literature.

The discussions of psychological variables within the team composition dimension have forwarded personality, general mental ability and psychological type as representing the unique characteristics and style attributes that define team psychological diversity. While the Five Factor Model was represented in most of the studies reviewed (Barrick, et al, 1998; Mohammed, et, al, 2002; Mohammed and Angell, 2003; Nueman, et al, 1999), the lack of sufficient research in this area has failed to produce any precedents or generally accepted procedures for operationalizing team composition along psychological lines. The Myers-Briggs Type Indicator appears sufficiently reliable and flexible enough to provide useful data for addressing the research questions put forth in Chapter 1.

The potential variety and degree of influence of both internal and external team stakeholders in the performance measurement equation challenges the development of objective outcome metrics. Team performance outcome measures are contingency-based constructs that are embedded in the context of the specific team or teams studied. This challenges the generalizability of findings among studies where subjects are steeped in the contexts of specific task and performance environments. However, it is clear that the outcome measures by which teams (as well as individuals) are ultimately assessed need to be well defined and fully expressed before success or failure of the team's performance may be determined.

The methods by which individual contributions to team success are quantitatively operationalized have led to a number of suggestions regarding team performance assessment. Data aggregation has stressed team measures of central tendency and variability as the most appropriate way of expressing team-level factors. However, the

transformational nature of in-tact work teams, combined with the purposeful nature of team design continues to challenge efficacy of the quantitative research in this field.

Difficulties with the experimental studies reviewed include the ad-hoc and short performance duration nature of the teams (see Day, et al 2004; Karakowsky, et al, 2004). For instance, real world teams in organizations perform numerous tasks over significant periods of time. However, experimental studies include same-day team assignments and performance measurements over 30 minute performance durations. Current experimental scenarios appear contrived and lack the social and psychological context of in-tact work teams in organizational settings. Therefore, the current review of literature fails to provide sufficient data or consensus that would allow the research questions currently under investigation to be satisfactorily answered at this time.

Emergent Propositions

From the foregoing literature review, each research question was examined to determine whether there was sufficient evidence to support one or more propositions to be tested as hypotheses.

The first research question asks whether there is a relationship between team psychological composition and team performance perceptions relative to team task type. The empirical work done in this area has operationalized psychological composition variables in a number of ways including general mental ability and the Five Factor Model (e.g. Barrick, et al, 1998; Mohammed & Angell, 2003). However, no empirical work was discovered in the literature relating the Myers-Briggs Type Indicator psychological type dimensions of teams with performance, with or without relevance to team task type. By contrast, a significant amount of research on teams in the 1980s and 1990s clearly

indicated that understanding the psychological dimensions of team composition are critical for development of task-based team performance measures (Guzzo & Dickson, 1996; Neuman, et al, 1999). The dependence of team performance on psychological composition variables appears generally accepted; however, it is modestly supported and only minimally understood.

Only one empirical study was found on the perceptions of teams with regard to their performance (Karakowsky, et al, 2004). However, the authors dismiss the value of asking team members to provide performance perception data; claiming no rational basis merely because their measures of "actual" team performance did not significantly correlate with concurrent team performance perceptions. Discounting team performance perceptions ignores a potentially valuable source of information regarding teams and performance. One may argue that team performance perceptions are especially salient, as much of the literature reports performance measures in terms of stakeholder evaluations that are, in many instances, perceptually biased proxies of "actual" performance (see Neuman, et al, 1999; Mohammed, et al, 2002; Mohammed and Angell, 2003).

No experimental studies relating team psychological composition variables to team performance were carried out on in-tact work teams. In contrast, the two experimental studies discovered by this research attempted to relate these variables by relying on ad-hoc teams of relative strangers who were asked to perform a variety of simulated tasks (Day, et al 2004; Karakowsky, et al, 2004). Experimental research has not yet determined an appropriate methodology for expressing the team composition and performance dynamic in a way that adequately represents a real-world, in-tact work team experience.

The lack of empirical research found in the existing literature does not allow a strong enough argument to be made that would suggest an answer to the first research question. Only minimal information exists that could weakly support a relational proposition regarding team psychological type diversity and team performance perceptions relative to team task type. Due to the lack of evidence, only the statement of a non-directional hypothesis as a basis for further research is available to address the first research question.

The second research question attempts to determine if a relationship exists between the degree of team psychological type diversity and the perceptions of the level of team performance relative to the type of task the team is faced with. Once more, there appears to be an absence of any empirical evidence on this question. The empirical evidence that does exist reports evidence in mixed support of team performance relationships with measures of team personality trait levels (Five Factor Model) as well as general mental ability (Barrick, et al, 1998; Mohammed, et al, 2002; Mohammed and Angell, 2003; Neuman, et al, 1999). However, none of the studies found in the literature attempt to investigate team psychological type diversity as a correlate of team performance regardless of task type.

The evidence from research on individual personality type and team member performance suggests that a similar relationship should exist at the team level (Bayne, 2004; Culp & Smith, 2001; Quenk, 2000). However, few attempts appear to have been made that relate psychological type diversity with performance at the team level, empirically or otherwise. The literature only suggests that team psychological type diversity and task-specific performance may be related in some way that currently

escapes empirical analysis. Therefore, the empirical evidence fails to provide a convincing argument to allow the statement of a proposition regarding the relationship between team psychological type diversity and performance, and only a non-directional hypothesis statement is possible.

Finally, no evidence in support of a relationship between team task characteristics and performance perceptions was discovered in the review of literature. Based on the literature review the summary in Table 1 guided the proposed research design for this study:

Table 1

Summary of Research Design Implications

Research Question	Proposition	Hypothesis
Is there a relationship between individual team member psychological type, and individual team member perception of team performance for each of the four Steiner task type scenarios?	No proposition is possible based on the empirical evidence identified as relevant to the question in the review of literature.	There is a relationship between individual team member psychological type, and individual team member perception of team performance for each of the four Steiner task type scenarios
Is there a relationship between team psychological type diversity and team perception of performance for each of the four Steiner task type scenarios?	No proposition was possible based on the empirical evidence identified as relevant to the question in the literature review.	There a relationship between team psychological type diversity and team perception of performance for each of the four Steiner task type scenarios
Is there a relationship between team task characteristics and individual team member perceptions of team performance?	No proposition was possible based on the empirical evidence identified as relevant to the question in the literature review.	There is a relationship between team task characteristics and individual team member perceptions of team performance

The following chapter explored the appropriate research design used to test the stated hypotheses, as well as gather additional data to confirm and add to what has been learned from the review.

CHAPTER 3: METHODOLOGY

Restatement of the Problem

To review, the purpose of this study was to determine whether a relationship exists between team member psychological type diversity and perceptions of performance, relative to team task type as defined by Steiner (1972). The study also considers whether team average psychological type diversity is related to team average perceptions of task-specific team performance. Specifically, this study examines, within the context of a formal educational setting, the following three research questions:

1. Is there a relationship between individual team member psychological type and individual team member perception of team performance for each of the four Steiner task type scenarios?
    - 1a. Are individual team member MBTI psychological type deviation scores related to the individual team member perceptions of team performance for each of the four Steiner task type scenarios?
    - 1b. Are individual team member MBTI dichotomy clarity index scores related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?
2. Is there a relationship between team psychological type diversity and team perception of performance for each of the four Steiner task type scenarios?

2a. Are team average MBTI psychological type deviation scores related to team average perceptions of performance for each of the four Steiner task type scenarios?

2b. Are team average MBTI dichotomy clarity scores related to team average perceptions of performance for each of the four Steiner task type scenarios?

3. Is there a relationship between individual perceptions of team task characteristics and individual member perceptions of team performance?

3a. Are individual team member perceptions of team task interest related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?

3b. Are individual team member perceptions of team task difficulty related to individual team member perceptions of team performance for each of the four Steiner task type scenarios?

3c. Do individual team member perceptions of team performance differ among the four Steiner task type scenarios?

In an attempt to identify the relationship between the variables of team member psychological type, team task type, team task characteristics and team performance perceptions, this associational study was based on empirical data gathering and analysis strategies. The context for this study was a bachelor's degree construction management program in a western United States educational institution that provides undergraduate and graduate education and training within the constraints of classroom-based activities

defined by the university. The construction management department was selected as the focus of this study for two reasons:

1. The content and curriculum of the team problem solving and leadership class was structured around intact teams performing identical, semester-long projects. While the sample size for quantitative research was relatively small (11 teams, $N = 95$), the subjects represented a unique opportunity to study a relatively large number of intact teams working on an identical problem.
2. Because the researcher was familiar with the course content and the department faculty, access to the population of students in the construction management department was possible. In addition, the results of this study were of interest to the construction management department as curriculum changes within the field of construction management education have increasingly relied on team-based performance models.

Subjects

The subjects for this study were undergraduate college students in a team problem solving and leadership class in a bachelor's degree construction management program in the western United States. The students enrolled in the team problem solving and leadership class composed the pool of potential subjects. Request for direct access was made to the class professor of record. Because the research was directly related to the curriculum and the subject matter of the class, the professor agreed to allow this direct access to the class by the researcher. Any concern about coercion over the potential

subjects is addressed, as the researcher had no power over any of the potential subjects. The total number of registered class students for the response pool was one hundred, eleven.

Instruments

The present research used two instruments for the collection of data: the *Myers-Briggs Type Instrument (MBTI), Form G,* which identifies psychological type as developed by Isabel Myers (as reported in Bayne, 2004), and the *Team Task and Performance Perceptions Questionnaire,* a survey designed by the researcher to identify perceptions of team members with regard to team tasks and team performance (see Appendix B).

Assistance was received from Mr. Ernie Lopez, a certified and experienced practitioner in the use of the MBTI. This instrument allowed the classification of subjects into their respective psychological type categories as described previously in chapters 1 and 2. Various forced-choice questions operationally define psychological type. The classification was achieved by summing the preferences of the subject responses on one or the other pole of the four dichotomies: Extroversion-Introversion (E-I), Sensing-Intuition (S-N), Thinking-Feeling (T-F) and Judging-Perceiving (J-P). This led to a four-letter type designation (e.g. ESTJ, INFP) for individual subjects. Additionally, the MBTI allowed for the calculation of a clarity index score (between1 and 30) for each of the four preference dichotomies. The clarity index score is a measure of how clearly an individual reports a preference for one or the other pole and is, therefore, considered an indication of individual clarity of preference.

Reliability and content validity of the MBTI was established by first noting the nearly fifty years of previous research based upon the instrument. More than 30 million people have taken the MBTI since 1975. With approximately 2 million people taking the MBTI annually, it is the most widely used instrument for assessing normal personality functioning (Quenk, 2000).

Two sets of information that address the reliability of the MBTI were reported by Myers and McCaulley (1990). First, internal consistency of continuous scores was addressed through X and Y split-half analysis. Each dichotomy index was split into halves. Items that most resembled one another and correlated most highly were paired. Internal consistency measures were derived from product-moment correlations of X and Y scores with Spearman-Brown prophecy correction. Total sample MBTI form G internal consistencies for both males and females (N = 32,671) reported for each of the E-I, S-N, T-F, and J-P preference scales were .82, .84, .83 and .86, respectively. The traditional age college student subgroup sample (N = 11,908) internal consistencies reported were .82, .81, .82 and .86, respectively.

Second, test-retest reliabilities address the likelihood that on retest, a participant will choose the same pole of all four dichotomous preferences, resulting in the same MBTI type as the initial test. Average test-retest reliability on each of the E-I, S-N, T-F, and J-P preference scales for periods of less than nine months reported by Myers, et al. (1998) for the E-I, S-N, T-F, and J-P preference scales were .82, .87, .82, and .83, respectively.

Reliabilities for the MBTI Form G remain stable for up to twenty five item omissions. This cut off point was used to determine the number of acceptable omissions

before a case would be dropped from this study. Additionally, reliabilities for different age groups tend to be somewhat lower for respondents in their teens and stabilize from the twenties onward. The Thinking-Feeling (T-F) scale reliability was found most likely to be depressed in younger respondents. Finally, response consistency showed a tendency to increase with level of achievement as well as level of aptitude for high school and college students (Myers and McCaulley, 1990).

The *Team Task Performance Perceptions Questionnaire* (see Appendix B) was designed by this researcher to allow respondents to report individual perceptions of their team's degree of difficulty with, interest in, and performance on the tasks required to successfully complete the proposed team project scenarios.

The subjects were asked to rate on six-point Likert scales their perceptions regarding team performance on the four task type scenarios (Steiner, 1972) for the completion of a hypothetical construction management project. Based on previous empirical evidence, the researcher developed these four task type scenarios which included disjunctive, conjunctive, additive, and discretionary team task completion strategies. For each task scenario there are two performance ratings. For the probability-of-success question, 1 to 6 represents "low probability" to "high probability", and for the performance question, "strongly disagree" to "strongly agree".

Team members were asked to report their perceptions of the task characteristics of the four task type scenarios by rating the degree of team task difficulty and team task interest for successful team project completion. The ratings on this scale are from 1 to 6 and represent "strongly disagree" to "strongly agree".

Content validity of the Team Task and Performance Perceptions Questionnaire was established by having four experts in the field of education and construction management independently review the instrument's content. This provided general support that the instrument measured what it intended to measure.

Data Collection

The subjects were provided with a direct, written request for participation in the study. The request was handed out in class before the administration of any instruments. The written request asked individuals to voluntarily participate in the study. Interested individuals were asked to sign a consent form allowing the collection of required data for the purposes of this research. Subjects were provided with copies of the signed consent form.

Data collection occurred during two separate class sessions at the construction management department. During the first class session, subjects were asked to complete the Myers-Briggs Type Indicator (MBTI). Administration of the Team Task and Performance Perceptions Questionnaire (TTPPQ) occurred under similar classroom conditions two weeks after the administration of the MBTI. This allowed for sufficient time to score the MBTI instrument and to provide the required results and feedback information to the subjects once the TTPPQ had been completed.

Measures

Team Psychological Type Composition. In addition to the MBTI raw score results, two measures were derived from the individual MBTI data. First, team member

individual MBTI deviation score was calculated as a function of the normed team psychological type. This was determined by summing the number of individual member dichotomy preference poles for each team. A simple majority of individual dichotomy preference poles established the team preference for each of the four dichotomies. For example, a team with seven members whose preferences on the Extroversion – Introversion (E – I) dichotomy was composed of four E's and three I's was considered a team with an Extroversion preference by simple majority

The deviation score was determined by counting the number of preference dichotomy poles of the individual type that were opposite of the team type. For example, an ESTJ member in an ESTJ team had a member type deviation score of 0. Conversely, an INFP individual in the same team resulted in a member type deviation score of 4. Deviation scores ranged from 0 to 4. *Team average MBTI deviation score* was calculated to address the team-level research question number 2.

Second, *MBTI clarity index scores* were recorded from the results of the MBTI. These are a measure of the degree of clarity by which individuals reported their preferences on each of the four dichotomies. The MBTI clarity index score, ranging from 1-30, was used to calculate the *team average MBTI clarity index score*. Prior research has equivocally shown that the use of both means and measures of variability was appropriate when aggregating individual scores to form team scores (Barrick, 1998).

Team Performance Perceptions. Individual perceptions were a fundamental part of the underlying psychological characteristics of interest to this study. Individual team members were asked to rate their team performance and probability of success for the four task type scenarios provided. Questions included: "I would rate my team's

probability of successfully completing the project requirements as follows" (answered, 1 = "low probability" to 6="high probability"), and, "I believe my team would perform very well on this project" (answered, 1="strongly disagree" to 6="strongly agree"). As the responses to these two questions correlated highly ($r > .50$), they were averaged to indicate a single, combined measure of team performance perceptions.

Team Task Characteristics. This study required the use of four team task scenarios that triggered varying perceptions of team performance relative to the composition of the team. The literature was noticeably silent with regard to team member perceptions of their performed tasks. Therefore, two measures of perception of task characteristics were derived from individual responses to the Team Task and Performance Perceptions Questionnaire. For each of the four task type scenarios, perceived *task difficulty* was assessed based upon individual response to the question: "I believe my team would find the project requirements difficult to perform successfully". Additionally, perceived team *task interest* was assessed based upon individual responses to the question: "I believe my team would find these project requirements interesting". Both of these questions were scored on a six-point Likert scale (answered, 1="strongly disagree" to 2="strongly agree").

Limitations of Research Design

Several limitations of the data collection method were identified. First, in this case, the instruments were administered to undergraduate students who are enrolled in an institution of higher education, and who have been involved in formal teamwork as a condition of course completion. While it is unlikely that subjects had reason to falsely influence the results of this study, a number of potential self-report biases may have

existed. Second, the generalizability of results collected through this convenience sample was of concern because: (1) a study built on a convenience sample limits statistical generalizability beyond the sample, (2) the small sample size is confounded further by the aggregation of individuals into single-data-points for teams, further reducing statistical power, and (3) the aggregation methods employed to represent team level measures have not been sufficiently studied or uniformly applied in past research.

Delimitations of Research Design

The inability of this study to generalize these findings to other populations in different contexts is noted here. Clearly the team problem solving and leadership class at the construction management department was a specific and unique formal educational environment. Any findings may not hold in corporate, government, or other environments.

Method of Statistical Analysis

The basic method of statistical analysis for this study was associational, using Pearson *r* to determine whether a relationship between team member MBTI deviation score and perception of team performance existed for each of the four Steiner task-type scenarios. Pearson *r* was used to determine whether there was a significant correlation between two or more of the normally distributed variables at a selected probability level. The concepts underlying associational questions, and subsequent use of inferential statistics, appeared most appropriate to this research due, in part, to the lack of consistent and validated prior research on this topic. The literature has progressed sufficiently in

proposing a number of potentially useful independent variables that have been shown to contribute to team performance. However, the fundamental relationships among these variables have not been firmly established nor been uniformly understood.

This research focused on individual and team-aggregated measures that were operationalized through the attributes of team variability in psychological type and clarity of type preferences, team task characteristics, and perceptions of team performance. Team psychological type was expressed nominally as one of the 16 MBTI psychological type categories. However, for the purpose of this study, team member MBTI deviation score was a normally distributed variable measuring the variation of individual team member psychological type relative to team psychological type. The clarity with which individuals and teams expressed their preferences was calculated as team average MBTI clarity index score, also a normally distributed variable.

Team task type scenario was represented categorically through the four Steiner (1972) task type scenarios. Team task performance characteristics were normally distributed through team member ratings of team task difficulty and team task interest. Perceptions of team performance were derived from the Likert scale data described above and were normally distributed. The measurement of normally distributed team composition and performance variables across each of the four Steiner (1972) task types represented a unique characteristic of this study relative to all of the prior research cited.

The research questions were addressed by the calculation of Pearson *r* correlation coefficients (alpha = .05) between normally distributed variables and coded for all task type categories. Here the researcher considered the potential for escalation of the

probability of type I error in the analysis with regard to the the Bonferroni Inequality and the number of probable type I errors within the study correlation matrix (Stevens, 1999).

According to Stevens (1999), the Bonferroni correction is often used to maintain the total probability of a type I error below 1, especially when a large number of statistical tests are used in the research. The correction is recommended for what is described as a more focused, confirmatory study where the theoretical or literature base is strong and the investigator wishes to target specific, often times directional, hypotheses.

In contrast, this research was exploratory in nature, testing only non-directional hypotheses. The large number of tests performed was required to address the individual research sub-questions, which used much smaller parts of the data set. The nature of this research suggests that the Bonferroni correction creates an overly stringent level of "protection" against type I errors for exploratory studies such as this.

The Bonferroni correction, as recommended by Stevens (1999), appeared to be a reasonable approach to address the researcher's preference not to waste time on "ghosts in the machine" (i.e. random findings that may require scarce resources to further investigate, or worse, direct policy based upon spurious claims). However, this research was built upon a weak literature base, was somewhat unfocused in nature, and had no immediate intervention or policy-related consequences. This approach has been referred to by some as a "fishing expedition" (p.97). Yet any good fisherman knows that one must first determine if there are any fish in the water before one begins to distinguish between species.

Therefore, relationships between team psychological type variables (average MBTI deviation and clarity index scores), task characteristics (difficulty and interest) and

performance (perceptual) were investigated among the four Steiner task-type scenarios at an overall alpha level of .05.

Research question 1(a) was addressed by correlating individual team member MBTI psychological type deviation scores with individual perceptions of team performance for the four task type scenarios resulting in four separate Pearson *r* values. Research question 1(b) was addressed by correlating individual team member MBTI psychological type clarity index scores with individual perceptions of team performance for the four Steiner task type scenarios. This resulted in four additional Pearson *r* values.

Research question 2(a) was addressed by correlating the average of the team member MBTI psychological type deviation scores with average team member perceptions of team performance for the four task type scenarios resulting in four separate Pearson *r* values. Research question 2(b) was addressed by correlating average team member psychological type clarity index scores with average team member perceptions of team performance for the four Steiner task type scenarios. This resulted in four additional Pearson *r* values.

Research 3(a) was addressed by correlating individual team member perceptions of team task interest with individual perceptions of team performance for the four Steiner task type scenarios. This resulted in four separate Pearson *r* values. Research question 3(b) was addressed by correlating individual team member perceptions of team task difficulty with individual perceptions of team performance for the four Steiner task type scenarios. This resulted in four additional Pearson *r* values.

Finally, research question 3(c) was addressed by performing one-way, repeated measures ANOVA with four levels to determine if significant differences existed

between individual perceptions of team performance across the four Steiner task type scenarios. This resulted in four separate F values.

CHAPTER 4: FINDINGS

This chapter presents the findings of the research by describing the implementation of the research methodology through the collection of primary data. First participant data from the Myers-Briggs Type Indicator (MBTI) is presented, followed by the data from the Team Task and Performance Perception Questionnaire (TTPQ). Next, descriptive data is presented along with an examination of the statistical results for the specific variable constructs of relationships. Finally, the chapter summarizes the quantitative information provided by the participants during data collection.

Methodological Implementation

Guided by the preceding investigation into the complexities of team psychological type and task performance the study proceeded by addressing the research questions through the collection and analysis of primary data. The MBTI instrument (Form G) was procured in paper format along with the requisite scoring sheets for the assessment of participant psychological type metrics. Variables of interest included individual participant MBTI classification, team MBTI classification (based upon team member modal occurrences within the four type dichotomies) and individual and team-level preference clarity scores. Though not of interest to this study, additional demographic data was recorded, including participant gender and age.

The Team Task and Performance Perceptions Questionnaire (TTPPQ) developed for this research was used to investigate participant perceptions of their team's performance for a hypothetical construction management project competition. Using a

single case problem statement, participants were asked to rate on a six-point Likert-type scale, their perceptions of the team's performance under four separate task scenarios modeled upon Steiner's (1972) typology. Performance perceptions were operationalized in the form of individual participant assessment of their team's interest, difficulty, performance and probability of success in completing the requirements of the competition problem statement. Participants reported perceptions of their team's performance with the competition problem statement by considering separately the prescribed team processes within each of the four distinct task scenarios.

Data Collection

The study participants included two sections of a college team problem solving and leadership class. Class sections met regularly once per week (section 1 on Mondays and Section 2 on Wednesdays) during the 1:00 – 3:00 p.m. class period. Class registration documents showed an enrollment of sixty-three students in section 1 and forty-eight students in section 2 for a total enrollment of one hundred, eleven students for the spring 2005 academic semester. Due to changes in actual class enrollment and absenteeism during the data collection periods, the data collection process yielded ninety-five actual study participants comprising eleven teams. Of these ninety-five participants, seven included partial data.

The data collection process for the study occurred over a 7 week period and comprised four separate visits to the classroom site. The first site visit included a brief introduction to the study and the completion of the study's participant consent forms. During the second site visit participants completed the MBTI. The third site visit allowed

participants to rate their team performance perceptions via the TTPPQ survey instrument. The fourth and final site visit was used to increase the participant sample size by encouraging participants with partial data to complete one or both of the MBTI and/or the TTPPQ as needed.

Study participants were first contacted during week 9 of the sixteen-week academic semester. During this class period students were introduced to the study's purpose and intent and were provided with a brief, scripted, verbal description of the research, the qualifications of the researchers, and the voluntary nature of student participation in the study. Students were then asked to provide written consent of their agreement to participate in the study via consent form prepared by the researcher and approved by the institution's human research review committee. Copies of the student consent forms were provided to the participants during the next data collection class period.

MBTI Data Findings

During week 11 of the class semester, participants completed the MBTI after a brief (approximately 15 minute) recap of the research project parameters. After completion the MBTI the researcher provided an overview lecture on personality testing as well as the current and historical literature on psychological type and performance metrics as it relates to teams. Data collection during this segment took approximately 50 minutes to complete.

The two weeks following the completion of the MBTI were spent hand scoring the MBTI results, completing the score sheets, preparing educational literature packets,

and inputting the data into an Excel spreadsheet for each study participant. An MBTI summary of results for individual participants is presented in Table's 2 and 3

Table 2.

Individual Participant Myers-Briggs Type Indicator (MBTI) Results (N=94)

ISTJ	ISFJ	INFJ	INTJ
8	1	1	3
ISTP	ISFP	INFP	INTP
15	0	0	3
ESTP	ESFP	ENFP	ENTP
15	3	7	10
ESTJ	ESFJ	ENFJ	ENTJ
24	1	0	3

Table 3

Grouped MBTI Component Data for All Study Participants

Dichotomy		Group
Extroversion (E) = 63	Introversion (I) = 31	Extroversion
Sensing (S) = 67	Intuition (N) = 27	Sensing
Thinking (T) = 81	Feeling (F) = 13	Thinking
Judging (J) = 41	Perceiving (P) = 53	Perceiving

Individual MBTI Data Findings

Once the individual MBTI data had been recorded, two of the study's primary variables for addressing research questions 1 and 2 were calculated. First, the individual

participant's clarity scores for each of the four dichotomies were summed to represent a total clarity score. Total clarity scores for individual participants ranged from 28 to 172, with an average total clarity score of 85.11, and a standard deviation of 30.7 (N=94).

Next, participant data was sorted by team affiliation in Excel, allowing for an initial visual inspection of the team MBTI data distribution as well as the calculation of the individual participant's MBTI deviation score. Recall that the deviation score is a measure of the degree of variance of each individual team member's MBTI score from their team's modal MBTI results. The team MBTI was determined by identifying which of the four type dichotomies represented a simple majority of occurrences among individual team members.

Team member deviation score was calculated by counting the number of times each individual team member's MBTI dichotomy preferences differed from that of the team. Individual deviation scores ranged from 0 – 4, with an average deviation score of 1.05, and a standard deviation of 0.94 (N=94).

Team MBTI Data Findings

Team MBTI clarity and deviation scores were calculated for each of the eleven teams in the study. Initial inspection showed that all teams (except team number 4) expressed clear and definitive MBTI profiles based upon the aggregation of individual team member MBTI scores. Team number 4 exhibited a "tie" on the Judging-Perceiving dichotomy, which required an adjustment to the individual deviation and average deviation score variables for this team (described below).

When groups were comprised of an even number of members, analysis of MBTI team type by simple majority of dichotomy preferences lead to a team MBTI that was "split" on one or more of the four dichotomies. In this instance the team was indicated to have a split dichotomy preference by recording both letters of the dichotomy with capitalization removed (e.g. ISTjp indicates this team split evenly on the Judging-Perceiving dichotomy). As this was the case for team number 4, an adjustment to individual and team deviation scores for this team was necessary to provide some degree of assurance that a split team would not skew the results of the subsequent statistical analysis that relied on these variables. Therefore, it was decided to add 0.5 to each individual team member's deviation score to account for the (jp) split within team number 4. This resulted in a team average deviation score of 1.0. The implications of this deviation score approach will be discussed further in the Results and Discussion sections of the following chapter.

Table 4 includes the team-level MBTI data calculated for each of the eleven teams in this study. The team MBTI deviation and total clarity variables represent averages of the individual team member scores. This team-level data will be used to address research question 2.

Table 4.

Summary of Team Myers-Briggs Type Indicator (MBTI) Data

Team	*N*	MBTI	Average Deviation Score	Total Clarity
1	8	ESTP	1.00	67.1
2	8	ESTJ	1.25	82.1
3	8	ESTJ	0.63	93.0
4	8	ISTjp	1.00	66.0
5	8	ESTP	1.13	84.8
6	8	ENTJ	1.13	85.1
7	8	ESTP	1.29	83.1
8	8	ESTJ	1.13	82.0
9	10	ESTP	0.82	100.2
10	11	ISTP	1.30	75.8
11	10	ISTP	0.64	104.0

Team Task and Performance Perceptions Findings

Participants completed the TTPPQ survey instrument during Week 14 of the semester. The timing of the instrument's application was chosen to maximize the team members' interaction time together during the semester. This was considered necessary to help offset the potential for time-related type one error, noted earlier (Harrison, et al, 2000), for identifying significant team performance variable correlations.

Participants were provided with the TTPPQ after a ten minute introduction and review of the research project. Individuals were asked to read the problem statement and answer the series of four identical questions for the four possible task scenarios to be considered for strategically completing the proposed problem statement project. Additional questions were included to ascertain the individual's perceptions of an actual team project that was performed during the semester, as well as a question that asked the team members to rate their desire to continue working with their teammates on future projects. Data collection for the instrument required approximately twenty-five minutes for all participants to complete and return. Table 5 lists the variables and descriptive data for the individual responses to the TTPPQ instrument.

Using a team sort in Excel, individual scores on the survey were grouped to establish team-level metrics of responses to the questionnaire. Individual responses to the items were averaged for each team to create a single data point for each question representing the team's average responses. This team aggregated data was then inputted into SPSS for statistical analysis.

During week 15 the researcher returned to the classroom as a follow-up to collect additional missing data from the study participant pool. This final classroom visit resulted in eleven additional individuals (one full additional team) qualifying as study participants. This data was processed and included to complete the overall data set.

Table 5.

Variables and Descriptive Statistics for Individual Responses to the Task Scenario Questions on the Team Task and Performance Perceptions Questionnaire

Task Scenario[a] Items	*M*	*SD*	*N*
Difficulty[b]			
Scenario 1 (disjunctive)	3.26	1.37	87
Scenario 2 (conjunctive)	3.70	1.42	87
Scenario 3 (additive)	2.61	1.22	86
Scenario 4 (discretionary)	2.97	1.28	86
Interest[c]			
Scenario 1 (disjunctive)	3.66	1.01	87
Scenario 2 (conjunctive)	3.48	1.08	87
Scenario 3 (additive)	4.07	0.93	86
Scenario 4 (discretionary)	3.93	0.97	86
Performance[d]			
Scenario 1 (disjunctive)	3.90	1.26	87
Scenario 2 (conjunctive)	3.33	1.26	87
Scenario 3 (additive)	4.47	1.08	86
Scenario 4 (discretionary)	4.28	1.20	86
Probability of Success[e]			
Scenario 1 (disjunctive)	4.08	1.26	87
Scenario 2 (conjunctive)	3.46	1.34	87
Scenario 3 (additive)	4.64	1.02	86
Scenario 4 (discretionary)	4.38	1.16	86

Note. [a]For the express task characteristics in scenarios 1 thru 4:
[b]Answers, "I believe my team would find these project requirements difficult to perform successfully" (strongly disagree = 1 / strongly agree = 6)
[c]Answers, "I believe my team would find these specific project requirements interesting" (strongly disagree = 1 / strongly agree = 6)
[d]Answers, "I believe my team would perform very well on this project" (strongly disagree = 1 / strongly agree = 6)
[e]Answers, "I would rate my team's probability of successfully completing these project requirements as follows:" (low probability = 1 / high probability = 6).

Quantitative Variable Findings

With the data from the MBTI and the TTTPQ survey entered into Excel, two spreadsheets were created to transfer the data into SPSS for subsequent statistical analysis. The first spreadsheet included individual data for all ninety-five study participants, which was used to address research questions 1 and 3. The second spreadsheet was created to allow team-level data to be manipulated for investigating research question 2. In the following presentation of results, statistically significant findings (alpha = .05) will be emphasized.

Descriptive and Relational Statistics

In an effort to inform the research questions, quantitative statistical analysis was performed on the individual and team participant data sets. Inferential statistical analysis of individual and team level variables performed in SPSS included several Pearson r correlations and one repeated measures ANOVA with four levels. Investigating these relationships involved associating measures of MBTI diversity and clarity with performance perception responses across the four task type scenarios. The following results are presented in the order in which the research questions were stated in Chapter 1.

Individual MBTI and Performance Perception Results

Research question 1 involved the association of individual participant Myers-Briggs Type Indicator (MBTI) deviation and clarity index scores with performance perception responses for two of the four questions within the task scenarios (scenario 1-4 performance and probability of success). Means and standard deviations for individual

participant MBTI variables used to address research question number 1 is presented in Table 6.

Table 6.

Individual Participant MBTI Variables and Descriptive Statistics for Research Question 1 (N=94)

	Descriptive Statistic	
Variable Description	*M*	*SD*
MBTI deviation score	1.05	0.94
Extroversion-Introversion clarity score	19.87	12.56
Sensing - Intuition clarity score	22.23	15.03
Thinking - Feeling clarity score	21.85	15.46
Judging - Perceiving clarity score	21.15	13.92
Total combined clarity score	85.11	30.68

Upon further review it was noted that each of the scenario-specific, performance related items (e.g. performance and probability of success) correlated highly with one another (r = .70 - .85). Therefore, the performance and probability of success item responses on the Team Task and Performance Perceptions Questionnaire were combined for each of the four scenarios to create an additional metric representing respondent's team combined performance perception. A summary of statistical results for research question 1 is presented in Table 7.

A Pearson r correlation matrix was developed using the individual participant data summarized in Tables 5 and 6 (above). The Sensing-Intuition (S-N) and Thinking-Feeling (T-F) clarity scores showed significant, negative, small to medium effect size

associations with performance perception ratings for the disjunctive (scenario 1) and conjunctive (scenario 2) task scenarios. Total MBTI clarity scores showed a significant, negative medium effect size association with performance perceptions for scenario 2. As participant S-N, T-F and total clarity scores increased, perceptions of team performance decreased for scenarios 1 and 2.

Table 7.
Individual Psychological Type and Performance Variable Correlations for Research Question 1(N=86)

	Deviation score	MBTI Dichotomy Clarity Scores				
		E-I	S-N	T-F	J-P	Total
Scenario1 (disjunctive)						
Performance	.023	.123	-.083	-.283**	.018	-.121
Probability of success	.017	.110	.110	-.249*	-.047	-.152
Combined performance	.027	.122	-.101	-.278**	-.015	-.143
Scenario 2 (conjunctive)						
Performance	.120	-.087	.223*	-.224*	-.001	-.252*
Probability of success	.034	.077	-.200	-.225*	.024	-.164
Combined performance	.087	-.003	-.220*	-.233*	.012	-.215*
Scenario 3 (additive)						
Performance	.013	-.087	-.052	-.003	-.081	-.099
Probability of success	.079	-.066	-.064	.015	-.154	-.120
Combined performance	.082	-.083	-.063	.006	-.126	-.118
Scenario 4 (discretionary)						
Performance	.155	-.115	.226*	-.035	.119	.101
Probability of success	.158	.007	.007	-.071	.040	-.011
Combined performance	.196	-.060	.129	-.057	.087	.050

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

The Sensing-Intuition (S-N) clarity scores showed a significant, positive, small to medium effect size association with performance perceptions for the discretionary task scenario (scenario 4). Thus, as S-N clarity scores increased, individual participants rated their team's performance increasingly higher for scenario 4. Individual participant Myers-Briggs Type Indicator (MBTI) deviation scores did not correlate significantly with any individual performance perception measures.

Team MBTI and Performance Perception Results

Exploring similar lines of inquiry, research question number 2 was addressed by repeating the investigation of psychological type and performance perceptions using aggregated, team-level data. In this analysis, a Pearson *r* correlation matrix of averaged team metrics, including MBTI deviation scores, MBTI clarity scores and task dependent performance perceptions was developed. Means and standard deviations of team aggregated variables used to address research question number 2 are presented in Table 8.

Again it was noted that the team average performance and team average probability of success items correlated highly (r = .70 - .85) within each of the four task scenarios. These items were averaged to create the additional team combined performance perception variable for each of the four task scenarios.

Table 8.

Team-Level Variables and Descriptive Statistics for Research Question # 2

	Descriptive Statistic ($N = 11$)	
Team Variable	*M*	*SD*
MBTI deviation score	1.03	0.24
Extroversion-Introversion clarity score	19.67	5.08
Sensing-Intuition clarity score	21.75	4.86
Thinking-Feeling clarity score	21.52	4.91
Judging-Perceiving clarity score	20.99	3.22
Total combined clarity score	83.93	11.95
Performance rating		
Scenario 1 (disjunctive)	3.88	0.38
Scenario 2 (conjunctive)	3.33	0.28
Scenario 3 (additive)	4.51	0.49
Scenario 4 (discretionary)	4.23	0.51
Probability of Success		
Scenario 1 (disjunctive)	4.07	0.38
Scenario 2 (conjunctive)	3.44	0.46
Scenario 3 (additive)	4.65	0.42
Scenario 4 (discretionary)	4.32	0.50
Combined Performance		
Scenario 1 (disjunctive)	3.98	0.36
Scenario 2 (conjunctive)	3.38	0.34
Scenario 3 (additive)	4.58	0.44
Scenario 4 (discretionary)	4.27	0.46

A Pearson *r* correlation matrix was created using the team data summarized in Table 8 (above). Team average MBTI Sensing-Intuition (S-N), Thinking-Feeling (T-F) and total clarity scores had significant, positive, very large effect size correlations with team average performance perception measures for scenario 4 (discretionary). Additionally, team average MBTI deviation scores had a significant, negative, large effect size correlation with the team average probability of success variable for scenario 4.

A summary of results for research question 2 is presented in Table 9. For scenario 4, teams rated their performance higher as their S-N, T-F and total clarity scores increased. Conversely, for scenario 4, team average probability of success ratings decreased as team average MBTI deviation scores increased. Interestingly, while the team average performance and probability of success measures for scenario 4 correlated highly with one another ($r = .667$), these variables exhibited highly disparate correlations when associated with team average MBTI deviation scores ($r = .043$, $p = .900$ and $r = -.641$, $p = .034$, respectively).

Individual Performance Perceptions Across Task Scenario Results

Research question 3(a) investigated the relationship between individual participant perceptions of team performance and the interest expressed by team members in the specific task strategies for project completion across the 4 task scenarios. Research question 3(b) investigated a similar relationship between individual perceptions of team performance and perceptions of the difficulty their team would experience performing the task-specific strategies for project completion across the 4 task scenarios. Due to the

highly correlated nature of the performance variables discussed above, the combined performance metric was utilized in the analysis of these questions.

Table 9.

Team-level Performance Variable Correlations for Research Question 2 (N=11)

	Deviation Score	Team MBTI Clarity Scores E-I	S-N	T-F	J-P	Total
Scenario 1 (disjunctive)						
Performance	-.090	.356	.244	.142	.468	.435
Probability of success	.099	.471	-.125	-.127	.408	.207
Combined performance	.005	.430	.061	.005	.459	.333
Scenario 2 (conjunctive)						
Performance	.085	.377	.182	.082	.211	.325
Probability of success	-.120	.557	.258	.180	.388	.520
Combined performance	-.050	.530	.250	.158	.350	.486
Scenario 3 (additive)						
Performance	-.017	.101	-.334	.201	-.303	-.092
Probability of success	-.360	.237	-.020	.384	.026	.257
Combined performance	-.179	.170	-.200	.295	-.160	.069
Scenario 4 (discretionary)						
Performance	.043	.198	.669*	.634*	-.002	.617*
Probability of success	-.641*	.361	.776**	.797**	.421	.910**
Combined performance	-.325	.304	.790**	.782**	.229	.834**

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

It was noted that the questions relating to task difficulty and task interest showed significant, negative, small effect size correlations for scenarios 2 and 4 ($r = -.254$, $p = .018$ and $r = -.221$, $p = .041$ respectively). While this will be discussed further in the

following chapter, this relationship did not express a consistency or degree of statistical significance to justify the combination of these variables for subsequent analysis.

Table 10 shows the results for research question 3(a) and 3(b). Within each of the four task scenarios, individual combined team performance ratings were correlated with the corresponding team task interest and task difficulty ratings. A significant, negative, overall large effect size correlation was found between performance perceptions and task difficulty ratings across all four task scenarios. Additionally, combined team performance ratings showed significant, positive, medium to large effect size correlations with task interest ratings for scenarios 2 - 4.

According to these results, as the team's average perception of task difficulty increases, the average perception of performance decreases. This relationship was shown to exist regardless of task scenario. Conversely, as the team's average ratings of task interest increases the average perception of team performance also increases. This relationship existed for three of the four task scenarios.

Table 10.
Correlations of Task Difficulty and Interest with Combined Performance Ratings for Research Question 3(a) and 3(b)

	N	Difficulty	Interest
Combined Performance			
Scenario 1 (disjunctive)	87	-.588**	.165
Scenario 2 (conjunctive)	87	-.586**	.288**
Scenario 3 (additive)	86	-.521**	.440**
Scenario 4 (discretionary)	86	-.340**	.477**

Research question 3c investigated whether individual participants perceived significant task-related differences in their team's performance across the four task

scenarios. Using the combined average performance perception variable, a repeated measures ANOVA, with sphericity assumed, was conducted to determine whether differences between average ratings of the combined performance ratings existed across the four task scenarios. Results indicated that the participants did rate their perceptions of team performance differently across the four scenarios; $F(3,255) = 24.32$, $p<.001$, $R^2 = .22$, eta = .47. The means and standard deviations for the performance ratings, listed in order from lowest to highest, are presented in Table 11. Contrasts showed both scenarios 1 and 2 differed significantly from scenarios 3 and 4.

As shown in Table 11, average combined performance ratings were significantly lower for scenarios 1 and 2 than for scenarios 3 and 4. The effect size for this difference was considered to be quite large, driven primarily by the very large effect size between scenario 2 and 3 (eta = .56) and the large effect size difference between scenario 1 and 3 (eta = .25).

Table 11.

Means and Standard Deviations of Individual Performance Ratings for the Four Task Scenarios

Variable	*M*	*SD*
Combined performance rating		
Scenario 2 (conjunctive)	3.40	1.25
Scenario 1 (disjunctive)	3.99	1.20
Scenario 4 (discretionary)	4.33	1.08
Scenario 3 (additive)	4.55	0.97

Other Quantitative Findings

In an attempt to add both color and depth to this analysis, the TTPPQ instrument tried to capture individual team member perceptions of their team's actual performance on a semester class project. The project involved the design and construction of an extreme weather survival shelter with both written and material deliverables as well as a team presentation of deliverables due during the final week of the semester class.

Three of the four questions that provided ratings of perceptions of team interest, difficulty and performance for the four hypothetical task scenarios were repeated with regard to the actual team semester project. Each participant was also asked to rate, on a scale from 1 – 6, their answer to the question, "I would like to continue working with this team on future projects" (1 = strongly disagree, 6 = strongly agree). A significant, positive relationship with a large effect size was found to exist between the team average total clarity scores and the team average ratings of desire to continue as a team, $r(11) = .70, p = .017$.

It was noted that individual team performance ratings showed significant, positive, medium effect size relationships with individual ratings of desire to continue as a team for all of the four task scenarios ($r = .261$ - $.406$). This suggests that an individual's desire to continue working with their team may be positively related to their perception of team performance. Additionally, each participant was asked to predict their team's final project grade on a scale of 1 – 100. On average, respondents believed their final project grade would be in the low "A" range.

A summary of results for individual participant perceptions of team performance on their semester project is provided in Table 12. On average, respondents rated their

actual semester project task difficulty as relatively low compared to the average of the four hypothetical scenarios (scenario 1- 4 average = 3.69). Actual team project task interest was somewhat below the average of the four scenario task interest ratings (scenario 1- 4 average = 3.79), exhibiting task interest more closely approximating scenarios 1 and 2 than scenarios 3 and 4.

Actual project performance ratings were higher than all of the four scenario performance ratings (scenario 1- 4 average = 4.00), suggesting participants perceived their team's performance on their semester project would have been higher than that of the four hypothetical task scenarios. Respondent ratings of their desire to continue working with their team were considered moderately strong, suggesting that, on average, team members viewed their teams somewhat positively with regard to working together on future projects.

Table 12.

Individual Participant Ratings of Performance for Actual Team Semester Project (N = 86)

Variable	*M*	*SD*
Actual project task difficulty	2.49	1.01
Actual project task interest	3.66	1.06
Actual project performance	5.01	0.79
Desire to continue as a team	4.13	1.36
Predicted actual project grade (1-100)	92.8	4.87

Finally, each participant was asked to consider which of the four task scenarios for the performance of the hypothetical problem best described the strategy that their team utilized in performing the requirements of their actual semester team project. The result of the question, "Considering the four team strategy scenarios presented above, I believe the one that best describes the strategy my team utilized to perform our semester project requirements was", is presented in Table 13.

Table 13.

Individual Participant Responses to Selection of the Steiner (1972) Task Scenario that Best Described Their Team's Strategy for Performing Their Actual Semester Team Project

Team Task Characteristics	Task Scenario	Count
Disjunctive tasks relies heavily on high performer(s)	Scenario 1	5
Conjunctive tasks subject to low performer(s)	Scenario 2	5
Additive tasks total effort of all performers summed	Scenario 3	38
Discretionary tasks weighted combination of efforts	Scenario 4	35

According to these results, forty-six percent of respondents perceived their actual semester project task characteristics most closely approximated the additive task scenario. This was followed by forty-two percent choosing the discretionary task scenario, and six percent each choosing the disjunctive and conjunctive scenarios. The overwhelming majority of respondents believed their team's task performance most closely approximated the additive or discretionary task scenarios.

Here the possibility was noted that individual team members who chose the discretionary scenario (i.e. teams were allowed the discretion to perform tasks in a manner of their own choosing) as most representative of their actual project task completion strategy may also have chosen to execute team tasks in a manner more consistent with the additive task scenario. This potential overlap of the Steiner (1972) task characteristic categories will be discussed further in the following chapter.

Summary of Statistical Findings

Table 14 summarizes the results of the statistical analysis performed for research questions 1 and 2. Results showed significant, negative correlations for individual S-N, T-F, and total clarity scores with combined performance ratings for scenario 2 (conjunctive). Additionally, individual T-F clarity scores correlated negatively with combined performance ratings for scenario 1 (disjunctive). Finally, individual S-N clarity scores correlated positively with combined performance ratings for scenario 4 (discretionary).

Team-level average S-N, T-F, and total clarity scores each correlated positively with combined performance ratings for scenario 4. Here the data showed the strongest support for relationships in the study. Each of the nine correlations had a larger than typical effect size, with the performance ratings significant at the alpha = .05 level, and the probability of success and combined performance ratings significant at .01. Finally, team average MBTI deviation scores correlated negatively with the average probability of success rating for scenario 4.

Table 14.

Summary of Findings for Individual and Team Average Composition and Performance Relationships Relative to the Four Steiner (1972) Task-Type Scenarios

	MBTI deviation scores		MBTI clarity index scores	
	Individual	Team	Individual	Team
Team Task Type				
Scenario 1 (disjunctive): Relies heavily on high performer(s)	_	_	T-F = -.28[a]	_
Scenario 2 (conjunctive): Meet minimum standards, depends on low performer(s)	_	_	S-N = -.22[b] T-F = -.23[b] Total = -.22[b]	_
Scenario 3 (additive): Total effort of all performers summed	_	_	_	_
Scenario 4 (discretionary): Weighted, situational combination of efforts	_	-.641[c]	S-N = .23[d]	S-N = .79[a] T-F = .78[a] Total = .83[a]

Note. Group *MBTI* type was ESTP (*N*=94). S-N = Sensing-Intuition, T-F = Thinking-Feeling. Individual results are for research question 1 (N=86). Team results are for research question 2 (N=11).

[a]Results were significant at the .01 level for the *combined performance* measure.

[b]Results were significant at the .05 level for the *combined performance* measure.

[c]Results were significant at the .05 level for the *probability of success* measure.

[d]Results were significant at the .05 level for the *performance* measure.

Table 15 summarizes the significant results for research question 3. Individuals rated combined performance negatively with increasing task difficulty ratings for each of the four task scenarios. In contrast, individuals rated combined performance positively with increasing task interest ratings for scenarios 2-4. Individuals also rated combined performance significantly higher for scenario 3 (additive) than for scenarios 1 (conjunctive), or 2 (disjunctive).

Table 15

Summary of Individual Team Member Perceptions of Team Task Characteristics and Performance Perceptions Relative to the Four Steiner (1972) Task-Type Scenarios (N=86)

	Difficulty	Interest	Combined performance	Team aggregation considerations
Team Task Type				
Scenario 1 (disjunctive): Relies heavily on high performer(s)	-.59[a]	.16	$M = 3.40$ [b]	Disproportionate for maximum score of one individual
Scenario 2 (conjunctive): Meets minimum standards, depends on low performer(s)	-.59 [a]	.29 [a]	$M = 3.99$ [b]	Disproportionate for minimum score of one individual
Scenario 3 (additive): Total effort of all performers combined	-.52 [a]	.44 [a]	$M = 4.55$	Summed or average scores = maximal / optimal outcomes
Scenario 4 (discretionary): Situational combination of performers effort	-.34 [a]	.48 [a]	$M = 4.33$	Weighted average = maximal / optimal outcomes

Note. Difficulty is for research question 3a, Interest is for research question 3b, and Combined performance is for research question 3c

[a]Pearson *r* is significant at the .01 level.

[b]Mean is significantly different from Scenario 3 & 4

Other statistical findings included a significant, positive correlation between team average total clarity scores and average ratings of desire to continue working with their team on future projects. Finally, eighty-eight percent of respondents expressed their perception that the actual team project they performed over the course of the academic semester included task characteristics that most closely aligned with the additive and the discretionary task scenarios.

CHAPTER 5: DISCUSSION

This chapter interprets the data findings from the preceding chapter. This chapter seeks first to interpret and draw conclusions from the statistical findings. Second, implications for future policy and practice are explored. Third, a discussion of the emergent limitations of this research is presented along with recommendations for future research. Finally, a review of the research project's results and conclusions completes the study.

Interpretation and Conclusion of the Quantitative Findings

The findings presented in Chapter 4 represent the total collected data set with reference to addressing the research questions expressed in Chapter 1. In an attempt to inform the research questions, these results will be further considered within the constraints of the specific research design of this study.

In addition, there exists the broader context of team task performance measurement. This includes team member perceptions of their team's interest in, and difficulty performing, the assigned tasks. Team task performance, as discussed in Chapters 1 and 2, involves the perceptions of multiple stakeholders, both internal and external to the team's membership boundaries. Recall that each stakeholder may have varying and different objectives and expectations with regard to the team's performance. The metrics that are used to express team performance, such as averages, standard deviations or minimum-maximum scores, begin to take on a broader context when task characteristics and stakeholder perceptions come into play.

The researcher encourages the reader to keep these factors in mind when considering the discussion of results that follows. These results support the existence of statistically significant relationships between measures of psychological type and task-specific performance perceptions among team members. These relationships were found to exist among variables that were measured at both the individual and team-aggregated levels.

Within the psychological type construct, team Sensing-Intuition, (S-N), Thinking-Feeling (T-F) and total clarity scores showed strong associational tendencies with the combined performance rating for the discretionary task scenario (scenario 4). The team MBTI deviation score metric exhibited less supportive evidence, correlating significantly only with the average probability of success rating for the discretionary task scenario.

Individual MBTI Thinking-Feeling clarity scores were related to participant's negative perceptions of team performance for the disjunctive (scenario 1) and conjunctive (scenario 2) task scenarios. Individual S-N and total clarity scores also supported negative team performance perceptions for the conjunctive scenario. After combining the performance and probability of success ratings, an overall negative perception of team performance for the conjunctive scenario emerged as it related to S-N, T-F, and total clarity scores. Additionally, the T-F clarity scores associated negatively with performance perceptions for the disjunctive task scenario.

As individual Sensing-Intuition, Thinking-Feeling and total clarity scores increased, the associated negative performance perceptions for the conjunctive task scenario also increased. Recall that under these task conditions, optimal team performance requires each member to perform to a minimum standard. Should one team

member fail to meet minimum requirements, the overall performance of the team would suffer. As individual Thinking-Feeling clarity scores increase, the perception of negative team performance for the disjunctive task increases. Within this scenario, task characteristics dictate that optimal team performance will be determined by the "best" performance of one or more "experts" within the team.

One may conclude from these results that individuals with increasingly higher S-N, T-F and total clarity scores become more pessimistic about their team's performance when outcomes disproportionately rely on the performance of those who are perceived as "weak links". For task characteristic that rely on acknowledged experts, high individual T-F clarity associated with increasingly negative performance perceptions. Specifically, higher individual Sensing-Intuition, Thinking-Feeling and total clarity index scores may indicate a dubious connection between team performance perceptions when outcomes rely heavily on members whose individual performance is perceived as substandard. Interestingly, for individuals with increasingly higher Thinking-Feeling clarity scores, these negative perceptions may also hold true when team success relies heavily upon the highest performing individual team member. Overall, team performance perceptions under disjunctive and conjunctive task conditions appear to be negatively impacted for individuals with high Thinking-Feeling (i.e. high Thinking) clarity scores.

In contrast to the negative team performance perceptions for scenarios 1 and 2, individuals with high S-N clarity scores did express significant, positive perceptions of team performance under the discretionary (scenario 4) task conditions. This indicates a degree of support for the premise that individuals with high S-N clarity scores perceive

higher team performance when the team is left to determine its own strategies and course of action with regard to task completion.

It is important to note that the overall group of participants expressed marked homogeneity on the Sensing-Intuition (S-N) and Thinking-Feeling (T-F) dichotomies. Of the total participant sample, the ratio of individual Sensing to Intuitive and Thinking to Feeling preferences was 67:27 and 81:13, respectively. This indicates that significant findings may only be applicable to groups disproportionately comprised of high Sensing clarity and high Thinking clarity individuals. Additionally, the proportions of Sensing:Intuition and Thinking:Feeling individuals within the study sample may have contributed to the low average MBTI deviations scores. This may have contributed to no significant findings between individual deviation scores and perceptions of team performance.

The interpretation of the individual participant results above sets the context for the team-level analysis that follows. Team average S-N, T-F and total clarity scores showed strong significantly positive associations with team average performance perceptions for the discretionary task scenario (scenario 4). These results suggest that, at the team level, perceptions of discretionary team performance is enhanced as average S-N, T-F and total clarity scores increase.

One may conclude that, on average, high clarity teams consider the discretion to determine their own task completion strategies an important factor contributing to higher team performance. In light of the small team sample size ($N = 11$) and the larger than typical effect sizes found at the alpha = .01 level, these results were highly supportive of

a relationship between team clarity of psychological type and performance perceptions when teams are empowered to decide how to complete complex project tasks.

Interestingly, average team MBTI deviation scores showed a strong, negative correlation with average team performance perceptions for scenario 4. This finding in contrast to Boone, et al. (1998), suggests that as team psychological type variability increases, average performance perceptions may suffer for discretionary tasks. One may therefore conclude that team psychological type diversity negatively impacts performance perceptions under discretionary task performance conditions. This finding contributes to the extant literature (see Barrick, et al., 1998), suggesting that team psychological type diversity may influence performance perceptions in a manner consistent with specific team tasks characteristics.

This study supported the literature in that individual team members perceive team performance will improve as task interest increases (Thompson, 2000). Conversely, team performance perceptions appear to suffer as the perception of task difficulty increases. These results suggest that team members may perceive optimal team performance occurs when tasks are low in difficulty as well as highly interesting. The medium to large effect size associations would support the hypothesis that task difficulty was negatively related to team performance across all task scenarios. In addition, support for task interest being positively related to team performance perceptions was found for three of the four task scenarios.

While the task difficulty and interest with performance perception relationships make sense taken at face value, the team performance literature suggests that, over time, the interaction of low difficulty / high interest tasks may lead to diminishing returns with

regard to performance (Thompson, 2000), due primarily to the effect of low task difficulty. Essentially, tasks that are perceived as easy to perform are not long considered challenging. This may eventually lead to decreased performance as interest wanes and boredom increases. While the results of this study suggest a strong relationship between team task performance and task interest and difficulty, further research is required to address the potential task interest and difficulty interaction as it relates to team performance.

Participant responses to the performance related questions (combined performance) were analyzed to determine if individual team members perceived significant differences in team performance across the four task scenarios. Performance ratings for the disjunctive and conjunctive task scenarios (scenarios 1 and 2) were shown to be significantly lower than performance ratings for the additive and discretionary task scenarios (scenario 3 and 4). Respondents may have perceived team performance to be enhanced when the team as a whole contributes to the completion of team tasks. In contrast, when performance disproportionately relies on one team member, team performance perceptions were shown to be significantly lower.

The analysis of individual participant team performance perception differences across task scenarios produced a noticeable trend in the data. While task scenario design was predicated upon the four Steiner (1972) categories (disjunctive, conjunctive, additive and discretionary), it appears that respondent ratings of performance fell into two "meta" categories. Respondents consistently rated perceptions of team performance lower for the disjunctive and conjunctive task scenarios and higher for the additive and discretionary task scenarios. These grouped categories (1 and 2, 3 and 4) are qualitatively different to

the degree in which they rely on individual maximum and minimum performance, as well as the collective performance of team members. These results suggest that task design and execution characteristics play an important role in how individuals rate the overall task performance of their teams.

The average individual participant response to the question that addressed team member desire to continue working together with their team on future projects ($M = 4.13$) suggests that individuals perceived their teams in a moderately positive light. These results, in conjunction with the significant correlations between desire to continue as a team and the combined performance perceptions for each of the four task scenarios supports the literature in that desire to continue as a team may be considered a legitimate measure of team performance (Barrick, et al, 1998).

Additionally, individual team members rated, on average, their actual semester project to be low in difficulty and moderately interesting. These results, combined with a high rating of perceived project performance, support the preceding analysis by suggesting that individuals perceive higher team performance results occur when task difficulty is relatively low and interest relatively high.

Finally, the overwhelming majority of participants perceived their actual team project task strategy characteristics most closely approximated the additive and discretionary scenarios (scenario 3 and 4) in the hypothetical problem statement from the Team Task and Performance Perceptions Questionnaire (TTPPQ). Interestingly, neither the literature nor the TTPPQ acknowledged that the discretionary task scenario (scenario 4) possesses characteristics that overlap the disjunctive, conjunctive and additive scenarios. By definition, under discretionary task conditions, teams are free to determine

the strategy by which tasks are performed. This characteristic separates the discretionary team task scenario from the other three scenarios with regard to the team's degree of autonomy (see Thompson, 2000) and control over their own task completion strategies.

Each of the four task scenarios implies an externally prescribed (i.e. external stakeholder determined) strategy for performing team tasks. However, the discretionary task scenario essentially shifts the decision of task performance strategy selection to the team. This results in an internally formulated task completion strategy among team members.

Additionally, no distinction was found between a team that perceived their task strategy selection to be internally determined (e.g. discretionary), but may have subsequently employed a task strategy that was executed in an additive or, for that matter, disjunctive or conjunctive, fashion. This suggests that the discretionary task scenario possesses characteristics that may potentially overlap or span the boundaries of the disjunctive, conjunctive, and additive task scenarios.

From a practitioner's perspective, this research raises additional questions because distinctions among significant relationships were found between the disjunctive / conjunctive task scenarios and the additive / discretionary task scenarios with regard to psychological type and team performance. Authors and scholars can reasonably argue that significant relationships exist between psychological measures and team performance. However, it is the position of this researcher that until the construct of team task type can be measured and integrated into the model; one cannot definitively claim that psychological measures show significant relationships with team performance with any degree of generalizability.

Implications for Future Policy and Practice

Several implications exist as a result of the analysis of the study's findings. To ensure the effective use of this research in future practice, the metrics for operationalizing team task, psychological type and team performance variability must first be refined. One of the qualitative findings of this study was the absence of discussion in the literature of task type metrics. The development of the Team Task and Performance Perceptions Questionnaire was an attempt to address this shortcoming in practical and meaningful terms. The results found here appear to bolster the literature supporting Steiner's (1972) task typology model. Task-type as a grouping variable needs to be further developed in future studies to address the distinctions among the team psychological type and team performance relationships found to exist within the current task-type framework.

Second, trained practitioners should be used to assist in identifying data trends and interpretation. During this study, teams were somewhat homogeneous on the MBTI Sensing-Intuition and Thinking Feeling dichotomies. The challenge lies in recognizing the sheer number of potential MBTI dichotomy combinations that can occur within the team setting. This should also be considered in the context of industry-specific trends in the MBTI literature suggesting certain professions, such as engineering or architecture, include individuals that exhibit consistent preference characteristics within specific MBTI dichotomies (Culp & Smith, 2001; Thomas, et al., 2000).

Third, the more teams are utilized in business and industry, the more important education and training becomes as a prerequisite to team participation; if the expectation is that teams will improve performance. Business and institutional teams rarely are

provided time to "train" or "practice" together for any extended periods of time. For most of the participants in this study, this was the first time they had ever participated in a structured team environment (other than in sports). Their participation added to their experience in the team environment, which could be transferred to future team work.

Today's organizations employ teams to improve performance and enhance effectiveness. However, many team members have no formal training and little experience working in a structured team environment. Just as individuals require continuing repetition and practice to improve task performance, teams need continuous skill development in coordinating those tasks to achieve team goals and improve organizational performance.

A popular view is that the most qualified team member is the person with the most task-specific content expertise and experience. This however places too much emphasis on task work as opposed to team work. The qualifications of individual knowledge, skill and ability should always be considered as team assets. However a policy that assumes that teams can work together effectively without understanding the basic psychological components of team behavior will too often lead to disappointing team performance.

Ultimately, the objectives and expectations of team stakeholders must be adequately assessed and made known to all concerned. Often times the objectives of organizational leaders remain vague or are purposely withheld from team members. This may lead to misalignment among team stakeholders with regard to expectations for future performance and success. A thorough assessment of team stakeholder objectives, as well

as team task characteristics, appears necessary to realize the potential performance enhancements desired by those who use teams in organizations.

Managers, trainers, leaders, and policy makers would benefit by further investigating the team performance model presented. Considerable research exists to educate and inform team stakeholders on the psychological and behavioral characteristics of individuals and teams. However, the classification of team task types into practical and useful tools for team stakeholder training appears highly situational and less well understood (Driskell, et al., 1987). Once team stakeholder objectives are clarified and disseminated, the alignment of team composition with team tasks may lead to more consistent and desired performance outcomes.

Discussion and Recommendations

This study attempted to focus on the discovery of relationships between team psychological type and performance under specific task-related constraints. In contrast, this research did not seek to measure or interpret the group dynamics of the teams studied. The challenge of distilling practical, meaningful findings with regard to team performance was compounded by the assumption that other influences, such as leadership styles, communication and social loafing (Thompson, 2000), were satisfactorily muted during the data collection phase of the research. Both the positive and negative effects of human social and group interaction were considered active during the study based upon respondent comments and observations of participant behaviors. Ultimately, this was a study of human perceptions, not human factors.

Emergent Limitations of the Research Design

One of the shortcomings of this study was the emphasis placed on measuring perceptions, rather than actual team performance. By limiting the research to team member perceptions, potentially valuable information from external team stakeholders was not included in the analysis. A number of factors contributed to limiting the scope of this investigation to performance perceptions rather than performance outcomes. These included the research participants and setting, the voluntary nature of the research and the hypothetical nature of the study's team task problem statement.

This research included students in a college class that involved a semester-long team project. The nature of the academic setting included stringent requirements limiting dissemination of student grades for actual team project work. Additionally, institutional and logistical constraints prevented the systematic collection of reliable "real-time" team performance results. Time and resource limitations for this class render instructor grading as the final measure of actual team performance. While instructor rating is a valuable source of team performance information, its reliability as an indicator of actual team performance has not been satisfactorily established.

The voluntary nature of the research was a potential limitation of the design of this study. While all participants took part voluntarily, they did not necessarily take part enthusiastically. For many, this study may have been perceived as an activity in a required class and conditional for matriculation within the institution's academic program. No evidence was discovered that suggests participants did not take this activity seriously. However, as in industry or business, teams were asked to participate in an effort that may or may not have held much importance for them. Unlike industry and

business teams, outcomes of the study's activities involved no adverse consequences had individuals exhibited disinterest or negative opinions of the study's worth.

The hypothetical nature of the study's team-task problem statement limited the applicability of the research to other team contexts or situations. An attempt was made to relate the hypothetical team-task problem statement to the actual project the teams were performing during the semester. The results suggest that teams perceived their performance of their actual semester project in a way that was consistent with the way they perceived the hypothetical team problem. However, these participants knew that the task scenarios were fictitious. There was no loss of credit, grade, personal reputation or negative consequences of any kind for expressing their team performance perceptions.

This research attempted to formulate and use data from the Myers-Briggs Type Indicator in a way that did not have many precedents in the literature. The use of the preference clarity index extended only to the magnitude, not the direction, of the score. While it was noted that respondents were somewhat homogeneous as a group, no attempt was made in this research to investigate the potential differences within the MBTI type dichotomies. Results were interpreted only to the degree that individual or teams expressed either high or low clarity with regard to their preferences. Finally, the calculation of a MBTI deviation score was an invention of this research.

Collectively, these factors may have contributed to limiting the scope of the research and therefore the generalizability of the results obtained. As a model for further investigation, these limitations should be addressed and integrated into subsequent analyses. Therefore future research is recommended to further investigate and develop the current model of psychological factors and task-specific team performance.

Recommendations for Future Research

A number of recommendations for future research have emerged as a result of the study's outcomes and limitations. First, additional research is needed to implement the study design in a real-time, industry or business team environment. The challenge is to find a sufficient number of teams that are willing and able to participate in such future studies. A bridge between college student and industry teams exists and may allow for more reliable and valid team performance data to be analyzed.

A number of potentially large sample populations of college student teams exist in the engineering disciplines and construction management professions. Annual and semi-annual student team competitions could provide a reliable source of actual performance data. This data is highly applicable to industry teams since it is industry advisors that develop the competition problem statements and rate the project deliverables. Of course, this would require a significant level of cooperation and coordination among university departments and industry organizations, which may be separated geographically and/or philosophically.

Another recommendation is that practitioners be encouraged to explore the extensive quantitative and qualitative matrices of team perception and behavior implied in the Myers-Briggs Type Indicator (MBTI), as it relates to team performance. Type preference clarity scores, as related to performance perceptions, appear particularly encouraging with regard to quantification and manipulation. Psychological type as expressed in the MBTI appears to possess strong potential as a reliable source of team psychological metrics. This is due in part to the rich interplay of the four type

dichotomies (Extroversion-Introversion, Sensing-Intuition, Thinking-Feeling, and Judging-Perceiving).

Perhaps further investigation of MBTI clarity scores with team performance perceptions could include individual clarity score variances (from the team average clarity scores) as an additional measure of team psychological type diversity. These could be correlated with individual and team aggregated measures of team performance perceptions to expand the current analysis and determine avenues of future research.

Industry teams are (somewhat belatedly) acknowledging the relevance of psychological variables as significant contributors to the team performance equation. Research should attempt to further investigate the relationship between psychological type and task-type variables through a systematic analysis of variance so as to discover possible interactions between team composition and task design that may affect team performance outcomes.

Research should begin by identifying patterns of team processes and behaviors within intact teams that correspond to those suggested in Steiner's (1972) task typology. Consequently, a research design that uses multiple task-type scenarios that are randomly assigned to different functional (as opposed to ad-hoc) teams has experimental merit. This approach would assume that participants are capable of differentiating between required processes within a team task-typology model. This could provide team members a deeper understanding of how different team task situations require different execution strategies to optimize team performance.

Future research should investigate and attempt to integrate the perspective of multiple internal and external team stakeholders with regard to team performance

assessment. In both academia and industry, teams rarely, if ever, get to determine the final ratings of their performance outcomes. While certain teams may be empowered to contribute to the review and assessment process, ultimate performance is most often determined by external stakeholders such as organizational superiors, experts, peer groups, customers, clients, or target audiences. The challenge of such a multiple rater design would be to establish a reliable rating system for identifying and assessing team performance outcomes.

Theoretical Considerations

This research attempted to form a highly theoretical problem into a practical and useful context. Team performance and the larger notion of group behaviors includes a multidimensional set of concepts and constructs. While this study bypassed the philosophical and epistemological dimensions of how individuals and groups perceive and behave under conditions of performance assessment, certain theoretical considerations were noted.

As expressed by Goldratt (1997), people will behave in a manner consistent with the way in which they are measured. This study suggested that teams perceived optimal performance to occur under discretionary task conditions, where teams were allowed to determine their own strategies for solving task related problems. But by what mechanisms do teams align their task strategy selections with stakeholder objectives and expectations to achieve superior outcomes? Perhaps history can shed some light on this fundamental question.

As early as the beginning of the eighteenth century the French physiocrats, such as Gourney, Quesney, Mirabeau, Du Pont Nemours, and Turgot, said "let nature (in

Greek, *physis*) rule (*kratein*); and if [man is] freed from unnecessary trammels he will astonish the world with the quantity, variety and excellence of his products" (Durant & Durant, 1967, p. 72). Guidance, of course, remains a necessity, and this must naturally come to teams through the discovery process of team stakeholder objectives and expectations. Once these have been thoroughly expressed and understood, a sound strategy may be to "'*Nouse laisser faire*-let us do it, let us alone'" (p. 72).

Finally, what wisdom can be distilled from this study of team composition, in all its myriad forms and combinations? Simple demographic differences were noted, of sufficient quantity and diverse quality that swamp any attempt at a "unified" theory of team compositional effects on performance. Add to this the complexities of psychological and environmental variability, making practical and useful sense of the relationship appears to escapes the grasp of all but sages and savants.

Perhaps an answer to these challenges can be found in our physical world as well as in our perceptions. Philosophers as far back as Lucretius, Democretes and Aristotle recognized that matter only takes on complex forms based upon natural laws that determine its properties and characteristics. In chemistry, for example, the concept of the limiting reagent suggests that compounds must include specific ratios of components to efficiently and effectively create the desired outcome (Change, 1998).

Applying this concept to the human sciences, one or more individuals within a team may be considered as a limiting agent. Whether it is the leader, the maximum or minimum performer, or the proportions of member knowledge, skill, ability or other factors brought together in the team, nature suggests that optimal outcomes occur when specific compositions of the variables within this research are purposefully combined. If

anything is to be construed from such theoretical musings, it is that effective, high performing teams are not created by chance. As it is possible to combine thousands of individual materials in nature, so too with teams, specific, proportionate combinations of individual members may lead to increasingly effective teams with regard to meeting objectives, achieving goals, and improving overall organizational performance.

Discussion and Conclusion

The intent of this research was to discover if significant relationships exist between team psychological type and team task performance measures. This study confirmed that some such relationships exist and that they may vary depending upon the specific nature of the team tasks performed. Greater insight was gained into the characteristics of team psychological types and task as they relate to the variability of team task performance perceptions.

Practitioners can appreciate the ease of use of the Myers-Briggs Type Indicator (MBTI) for providing reliable measures of psychological type for team members. The design of the MBTI allows for the analysis of a diverse set of psychological variables in describing the unique preferences and behaviors of individual team members.

The MBTI lends itself to the development of team-aggregated psychological type variables at the normally distributed data level. It is important to note that the individual personality type data included two primary measures; MBTI clarity, and deviation scores. The MBTI clarity scores represent a true individual measure, as each participant expressed their own preference clarity on the instrument. The MBTI deviation score, however, was calculated as an individual variance from a team mode. The deviation score

metric is therefore a quasi-team measure, as the team MBTI is required for calculating the individual MBTI deviation score.

Prior to the commencement of data collection, it would have been impossible to know how diverse the participants were with regard to psychological type. Only after the instrument was administered did the degree of homogeneity of individual preferences become clear. This limited the applicability of the MBTI deviation score, as both an individual measure of team member type variability and, in particular, a team-level metric, due to the small sample size (e.g. $N = 11$ for team-level measures). Yet, in light of all these potential limitations, evidence was noted that suggests that further research into this "quasi-team" metric could provide useful information.

This distinction becomes important in light of the emphasis found in the literature on the method of aggregating team metrics (mean, variance, maximum and minimum). MBTI clarity scores are a simple, individual measure for psychological type variability that was aggregated (averaged) to create a team measure. MBTI deviation scores were a more complex measure of team psychological type variability. As such, they are an indication of individual team member psychological type relative to a team modal type. In this study, the simple measure appeared to penetrate the relationship more deeply, as MBTI clarity scores were involved with all but one of the significant relationships found with the task-specific team performance perception variables.

The relationship of team-task type and performance perceptions posed the most challenging questions for this (and future) research. How can team performance be reasonably determined without including some measure of the context and conditions under which teams are required to perform? Are qualitative descriptions of team task type

sufficient for a thorough analysis of team performance? If not, what will future quantitative measures of team task type look like? It is important that these and other questions be investigated in an attempt to create sound ground rules for performance evaluation and decision making.

Finally, this study revolved around the notion that team performance includes both perceptions and measurable outcomes. Even with the most "objective" assessment of performance, such as the number of parts produced in an hour or problems solved in a week, significant subjective factors based upon stakeholder perceptions will influence team performance. Future research in this area will struggle with how to capture team stakeholder performance perceptions versus how teams are actually performing both during and after task completion. Perhaps the answer to the team performance question lies in a consensus or alignment of values among all of the team's stakeholders, both internal and external. The value may lie, not in single, objective criteria for successful performance outcomes, but in reasonable and rational processes that both inform and rely upon stakeholder input. This can be used to chart a course and articulate useful metrics for describing successful team performance.

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APPENDIX A: GLOSSARY OF TERMS

Glossary of Terms

Additive team task: indicates team task characteristics whereby the sum of all member performances typically influences overall team performance (Steiner, 1972).

Conjunctive team task: indicates team task characteristics whereby the performance of an individual "weak link" or otherwise low performing member typically influences overall team performance disproportionately (Steiner, 1972).

Discretionary team task: indicates team task characteristics whereby member performances are typically combined using a variable "weighted average" formula to influence overall team performance (Steiner, 1972).

Disjunctive team task: indicates team task characteristics whereby the performance of an individual "expert" or otherwise high performing member typically influences overall team performance disproportionately (Steiner, 1972).

Myers-Briggs Type Indicator (MBTI): survey instrument requiring forced-choice preferences to be expressed along four dichotomies (extroversion-introversion, sensing and intuition, thinking and feeling, and judging and perceiving), resulting in 16 possible, discrete psychological types, as designated by a four-letter code (e.g., ENFP = extroversion-intuition-feeling-perceiving), which is purported to encompass the conscious aspects of an individual's preferences in directing and controlling their endeavors (Quenk, 2000).

MBTI clarity index score: ranging from 1-30, is a metric found within the Myers-Briggs Type Indicator that measures the degree of clarity by which individuals report their preferences on each of the four dichotomies (Bayne, 2004).

MBTI deviation score: is calculated by summing the number of MBTI preference dichotomy poles of the individual member type that were opposite of the team type.

Psychological type: theory says that each person is an individual, that his or her type is an important element in that individuality, and that our behavior is influenced by our type, but certainly not restricted to it. Further, in its Myers-Briggs Type Indicator theory meaning, it implies that people are very similar in some respects (nearly everyone uses all the preferences some of the time) but also profoundly and fundamentally different (people are different in kind, not just degree) (Bayne, 2004).

Team: is a group of people who are interdependent with respect to information, resources, and skills and who seek to combine their efforts to achieve a common goal (Thompson, 2000).

Team composition: as a compilation of multiple members attributes, is described by a mix of individual knowledge, skills, abilities and other factors including psychological and demographic characteristics (KSAOs) (Mohammed, Mathieu & Bartlett, 2002).

Team homogeneity-heterogeneity: is a measure of the composition of a team, which deals with member's average scores on attributes as well as with their dispersion around these averages (Steiner, 1972). For the purposes of this study, *team diversity* and *team homogeneity-heterogeneity* were used interchangeably.

Team psychological type: is determined by summing the number of individual member MBTI dichotomy preference poles for each team. A simple majority of individual dichotomy preference poles established the team preference for each of the four dichotomies.

Team Stakeholders: including internal or external team constituents, are those who typically provide team performance analysis, assessment and information and feedback, (e.g. team members, supervisors, human resource managers, clients, co-workers, etc.)

Team task type: is a determination of a team job requirement activity as being (a) disjunctive, (b) conjunctive, (c) additive, or (d) discretionary with regard to the processes permitted or prescribed and the resources available (Steiner, 1972).

APPENDIX B: INSTRUMENT

Team Task and Performance Perception Questionnaire Instrument

TTPPQ Code (please print): _____

Please consider the following construction management team problem: Once you have completely read the problem statement, you will be provided with four possible team strategy scenarios for the successful completion of the project, along with a series of questions asking you to **assess your team's ability to successfully complete the project requirements.**

Problem Statement: Your team is required to prepare a management plan proposal for the construction of a multi-unit (6 units), luxury condominium at the base of a major Colorado ski resort. Your team is competing with all other teams in the Spring semester class. Assume that the entire class semester would be dedicated to this project with all deliverables due the Friday before finals week.

The successful proposal must include the following deliverables (paper & digital format):

1. Conceptual Drawings: sample floor plans, elevations and schematics in both paper and digital (CAD) formats.
2. Pre-construction Logistics Report: Including all necessary legal and regulatory requirements, agencies, contacts and submittals for project approval and development.
3. Conceptual and Parametric Cost Estimate: Including identification and budgeting of major scope requirements and proposed construction material systems by CSI division.
4. Preliminary Construction Schedule: Including pre-construction, construction and closeout phases. Major scheduling milestones to be linked to project cost estimate
5. Value Engineering Report: Including sustainable and green-built scope alternatives with associated up-front and life-cycle cost analysis.
6. Presentation Video: Including a professionally formatted team presentation of team project proposal. All team members must be included. Maximum duration = 20 minutes.

Success = winning the competition. For each strategy scenario, assume all class teams are required to compete under identical conditions and constraints. For each scenario below, only one (1) team video is required.

Scenario #1:

Each team member must individually prepare a proposal for submission. One week before the submittal deadline, the team will meet to select the one "best" individual proposal to represent your final team submittal. Your team will submit the one "best" proposal by the submittal deadline.

	strongly disagree					strongly agree
I believe my team would find these specific project requirements interesting	1	2	3	4	5	6
I believe my team would find these project requirements difficult to perform successfully	1	2	3	4	5	6
I believe my team would perform very well on this project	1	2	3	4	5	6
	low probability					high probability
I would rate my team's probability of successfully completing these project requirements as follows:	1	2	3	4	5	6

Scenario #2:
Each of your team members must individually prepare a proposal for submission. All team members must submit their individual proposals for final review by the submittal deadline. Once submitted, if any of the individual team-member proposals do not meet the minimum requirements listed above, your team will be disqualified from the competition

	strongly disagree					strongly agree
I believe my team would find these specific project requirements interesting	1	2	3	4	5	6
I believe my team would find these project requirements difficult to perform successfully	1	2	3	4	5	6
I believe my team would perform very well on this project	1	2	3	4	5	6

	low probability					high probability
I would rate my team's probability of successfully completing these project requirements as follows:	1	2	3	4	5	6

Scenario #3:
Each of your team members (or member pairs) will be assigned complete responsibility for one of the six major submittal requirements listed above. One week before the submittal date, your team will meet and combine these components into a single team proposal to be submitted by the deadline

	strongly disagree					strongly agree
I believe my team would find these specific project requirements interesting	1	2	3	4	5	6
I believe my team would find these project requirements difficult to perform successfully	1	2	3	4	5	6
I believe my team would perform very well on this project	1	2	3	4	5	6

	low probability					high probability
I would rate my team's probability of successfully completing these project requirements as follows:	1	2	3	4	5	6

Scenario #4:
Your team may proceed under any strategy they see fit (self-directed) to complete the proposal requirements by the submission deadline. Your team is required to submit one team proposal for review by the submission deadline.

	strongly disagree					strongly agree
I believe my team would find these specific project requirements interesting	1	2	3	4	5	6

	strongly disagree					strongly agree
I believe my team would find these project requirements difficult to perform successfully	1	2	3	4	5	6
I believe my team would perform very well on this project	1	2	3	4	5	6
	low probability					high probability
I would rate my team's probability of successfully completing these project requirements as follows:	1	2	3	4	5	6

Finally, please answer the following questions regarding the **actual project your team performed this semester**

	strongly disagree					strongly agree
My team found the requirements of our semester project to be interesting	1	2	3	4	5	6
My team found the requirements of our semester project difficult to perform successfully	1	2	3	4	5	6
I believe my team will perform very well on our semester project	1	2	3	4	5	6
I would like to continue working with this team on future projects	1	2	3	4	5	6

I predict my team's total grade score on our semester project will be

Please write in grade score (1-100)_____

Considering the four team strategy scenarios presented above, I believe the one that best describes the strategy my team utilized to perform our semester project requirements is **(circle one):**

Scenario #1 Scenario #2 Scenario #3 Scenario #4

Comments: (your comments on this research or this class are always appreciated):

APPENDIX C: DETAILED STATISTICAL TABLES

Table C1.

Correlations of individual team member Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Individual Myers-Briggs Type Indicator					
	Deviation score	E-I clarity	S-N clarity	T-F clarity	J-P clarity	Total clarity
Individual Myers-Briggs Type Indicator						
Deviation score	1					
Extroversion-introversion (E-I) clarity	-.133	1				
Sensing-intuition (S-N) clarity	-.018	-.078	1			
Thinking-feeling (T-F) clarity	-.282**	.003	.109	1		
Judging-perceiving (J-P) clarity	-.001	.008	.219*	.020	1	
Total clarity	-.206*	.376**	.612**	.567**	.574**	1
Individual TTPPQ						
Scenario 1						
Difficulty	.120	-.065	.133	.383**	.040	.244*
Interest	.073	.015	.092	-.102	.128	.057
Performance	.023	.123	-.083	-.283**	.018	-.121
Probability of success	.017	.110	-.111	-.249*	-.047	-.152
Combined performance	.027	.122	-.101	-.278**	-.015	-.143
Scenario 2						
Difficulty	-.076	-.036	.092	.204	-.011	.125
Interest	.156	-.051	.038	-.235*	.144	-.052
Performance	.120	-.087	-.223*	-.224*	-.001	-.252*
Probability of success	.034	.077	-.200	-.225	.024	-.164
Combined performance	.087	-.003	-.220*	-.233*	.012	-.215*
Scenario 3						
Difficulty	-.067	.083	.047	.094	.040	.121
Interest	.044	.045	-.090	-.005	-.041	-.047
Performance	.013	-.087	-.052	-.003	-.081	-.099
Probability of success	.079	-.066	-.064	.015	-.154	-.120
Combined performance	.082	-.083	-.063	.006	-.126	-.118
Scenario 4						
Difficulty	-.158	.034	-.047	.070	.063	.054
Interest	.113	-.195	.050	-.056	.171	-.004
Performance	.155	-.115	.226*	-.035	.119	.101
Probability of success	.158	.007	.007	-.071	.040	-.120
Combined performance	.196	-.060	.129	-.057	.087	.050
Desire to continue as a team	.166	-.043	.021	-.134	.062	-.045

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C1, Continued.

Correlations of individual team member Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Individual TTPPQ Scenario 1				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Individual TTPPQ					
Scenario 1					
Difficulty	1				
Interest	-.154	1			
Performance	-.538**	.142	1		
Probability of success	-.586**	.173	.827**	1	
Combined performance	-.588**	.165	.956**	.956**	1
Scenario 2					
Difficulty	.549**	-.124	-.212*	-.311**	-.274*
Interest	-.111	.394**	.029	.057	.045
Performance	-.381**	-.102	.410**	.429**	.438**
Probability of success	-.481**	-.094	.423**	.461**	.463**
Combined performance	-.449**	-.102	.433**	.463**	.469**
Scenario 3					
Difficulty	.274*	-.086	.164	-.112	-.144
Interest	.086	.348**	-.214*	-.214*	-.224*
Performance	-.219*	.129	.096	.140	.123
Probability of success	-.225*	.181	.144	.258*	.210
Combined performance	-.241*	.167	.130	.214*	.179
Scenario 4					
Difficulty	.226*	-.143	-.235*	-.210	-.233*
Interest	-.048	.349**	.100	-.015	.044
Performance	-.075	.110	.269*	.104	.195
Probability of success	-.183	.072	.364**	.303**	.349**
Combined performance	-.139	.099	.343**	.219*	.294**
Desire to continue as a team	-.278**	.092	.262*	.270*	.278**

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C1, Continued.

Correlations of individual team member Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Individual TTPPQ Scenario 2				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Individual TTPPQ					
Scenario 2					
Difficulty	1				
Interest	-.254*	1			
Performance	-.506**	.291**	1		
Probability of success	-.618**	.264*	.851**	1	
Combined performance	-.586**	.288*	.960**	.964**	1
Scenario 3					
Difficulty	.291**	-.137	-.225*	-.188	-.214*
Interest	-.020	.270*	-.150	-.148	-.155
Performance	-.254*	.196	.237*	.149	.200
Probability of success	-.292**	.130	.264*	.258*	.271*
Combined performance	-.295**	.178	.272*	.219*	.254*
Scenario 4					
Difficulty	.464**	-.192	-.191	-.260*	-.235*
Interest	-.066	.370**	-.040	-.040	-.041
Performance	-.110	.130	.168	.114	.146
Probability of success	-.131	.140	.336**	.300**	.330**
Combined performance	-.131	.146	.272*	.223*	.257*
Desire to continue as a team	-.358**	.102	.205	.269*	.248*

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C1, Continued.

Correlations of individual team member Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Individual TTPPQ Scenario 3				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Individual TTPPQ					
Scenario 3					
Difficulty	1				
Interest	-.172	1			
Performance	-.528**	.423**	1		
Probability of success	-.429**	.388**	.700**	1	
Combined performance	-.521**	.440**	.927**	.917**	1
Scenario 4					
Difficulty	.444**	.032	-.295**	-.127	-.232*
Interest	-.103	.371**	.144	.058	.111
Performance	-.206	-.018	.254*	.055	.170
Probability of success	-.116	-.156	.081	.139	.118
Combined performance	-.176	-.093	.183	.104	.157
Desire to continue as a team	-.232*	.218*	.323**	.406**	.395**

* Correlation is significant at the 0.05 level
** Correlation is significant at the 0.01 level

Table C1, Continued.
Correlations of individual team member Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings s for the four task scenarios

	Individual TTPPQ Scenario 4					
	Difficulty	Interest	Performance	Probability of success	Combined performance	Desire to Continue as a Team
Individual TTPPQ Scenario 4						
Difficulty	1					
Interest	-.221*	1				
Performance	-.371**	.546**	1			
Probability of success	-.253*	.328**	.695**	1		
Combined performance	-.340**	.477**	.923**	.918**	1	
Desire to continue as a team	.-.154	.298**	.261*	.336**	.324**	1

* Correlation is significant at the 0.05 level
** Correlation is significant at the 0.01 level

Table C2.

Correlations of team average Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Team Average Myers-Briggs Type Indicator					
	Deviation score	E-I clarity	S-N clarity	T-F clarity	J-P clarity	Total clarity
Team Average Myers-Briggs Type Indicator						
Deviation score	1					
Extroversion-introversion (E-I) clarity	-.207	1				
Sensing-intuition (S-N) clarity	-.335	-.067	1			
Thinking-feeling (T-F) clarity	-.456	.250	.745**	1		
Judging-perceiving (J-P) clarity	-.635*	.448	.025	-.041	1	
Total clarity	-.583	.621*	.691*	.809**	.453	1
Team Average TTPPQ						
Scenario 1						
Difficulty	-.174	-.575	.676*	.362	-.173	.133
Interest	-.018	.006	-.125	-.059	.457	.050
Performance	-.089	.356	.244	.142	.468	.435
Probability of success	.099	.471	-.125	-.127	.408	.207
Combined performance	.005	.430	.061	.005	.459	.333
Scenario 2						
Difficulty	-.129	-.291	-.111	-.312	.002	-.297
Interest	-.247	-.197	.158	.159	.384	.149
Performance	.085	.377	.182	.082	.211	.325
Probability of success	-120	.557	.258	.180	.388	.520
Combined performance	-.050	.530	.250	.158	.350	.486
Scenario 3						
Difficulty	.126	.473	.067	-.278	.460	.238
Interest	.007	-.091	-.580	-.158	-.119	-.371
Performance	-.017	.101	-.334	.201	-.303	-.092
Probability of success	-.360	.237	-.020	.384	.026	.257
Combined performance	-.179	.170	-.200	.295	-.160	.069
Scenario 4						
Difficulty	-.288	.257	-.150	-.304	.427	.038
Interest	.017	.023	.425	.429	.124	.393
Performance	.043	.198	.669*	.634*	-.002	.617*
Probability of success	-.641*	.361	.776**	.797**	.421	.910**
Combined performance	-.325	.304	.790**	.782**	.229	.834**
Desire to continue as a team	-.315	.260	.578	.587	.417	.699*

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C2, Continued.

Correlations of team average Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Team Average TTPPQ Scenario 1				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Team Average TTPPQ					
Scenario 1					
Difficulty	1				
Interest	-.105	1			
Performance	-.281	.550	1		
Probability of success	-.487	.529	.844**	1	
Combined performance	-.401	.563	.961**	.960**	1
Scenario 2					
Difficulty	.325	-.522	-.690*	-.565	-.652*
Interest	.221	.855**	.502	.299	.418
Performance	-.251	.347	.802**	.850**	.859**
Probability of success	-.141	.202	.426	.451	.456
Combined performance	-.197	.279	.426	.421	.657*
Scenario 3					
Difficulty	-.162	-.066	.219	.235	.239
Interest	-.294	.169	-.137	.053	-.046
Performance	-.498	.057	.055	.166	.112
Probability of success	-.351	.130	.384	.428	.420
Combined performance	-.450	.095	.215	.300	.266
Scenario 4					
Difficulty	-.141	-.098	.233	.483	.372
Interest	.192	.469	.395	.091	.255
Performance	.280	.258	.482	.213	.362
Probability of success	.325	.078	.418	.174	.308
Combined performance	.333	.186	.492	.212	.366
Desire to continue as a team	.256	.497	.443	.226	.349

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C2, Continued.

Correlations of team average Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Team Average TTPPQ Scenario 2				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Team Average TTPPQ					
Scenario 2					
Difficulty	1				
Interest	-.521	1			
Performance	-.718*	.301	1		
Probability of success	-.487	.124	.695*	1	
Combined performance	-.622*	..209	.875**	.957**	1
Scenario 3					
Difficulty	.140	-.260	.207	.535	.445
Interest	.085	.053	-.313	-648*	-.564
Performance	-.350	-.019	.035	-.324	-.204
Probability of success	-.445	.163	.378	-.035	.131
Combined performance	-.412	.068	.203	-.200	-.051
Scenario 4					
Difficulty	.163	-.129	.435	.315	.387
Interest	-.350	.526	.058	-.052	-.008
Performance	-.503	.381	.384	.278	.346
Probability of success	-.167	.255	.277	.312	.326
Combined performance	-.365	.349	.361	.321	.366
Desire to continue as a team	-.350	.545	.279	.371	.367

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C2, Continued.

Correlations of team average Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Team Average TTPPQ Scenario 3				
	Difficulty	Interest	Performance	Probability of success	Combined performance
Team Average TTPPQ					
Scenario 3					
Difficulty	1				
Interest	-.597	1			
Performance	-.723*	.651*	1		
Probability of success	-.609*	.452	.839**	1	
Combined performance	-.699*	.583	.966**	.951**	1
Scenario 4					
Difficulty	.251	.046	-.163	.204	.005
Interest	.007	-.203	-.030	-.034	-.032
Performance	.100	-.456	-.104	.042	-.037
Probability of success	.055	-.342	-.058	.332	.124
Combined performance	.085	-.437	-.090	.203	.046
Desire to continue as a team	.136	-.421	-.145	.070	-.048

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table C2, Continued.

Correlations of team average Myers-Briggs Type Indicator scores and team task interest, difficulty and performance perception ratings for the four task scenarios

	Team Average TTPPQ Scenario 4					
	Difficulty	Interest	Performance	Probability of success	Combined performance	Desire to continue as a team
Team Average TTPPQ Scenario 4						
Difficulty	1					
Interest	-.652*	1				
Performance	-.438	.850**	1			
Probability of success	.031	.502	.667*	1		
Combined performance	-.224	.742**	.914**	.912**	1	
Desire to continue as a team	-.318	.821**	.828**	.784**	.884**	1

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level