The team KSA test: development and validation

by

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B.S., North Central University, 1992
M.S., Kansas State University, 2017

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Abstract

People working together in teams for a common purpose has been a centerpiece of human social organization since our ancient ancestors first banded together to hunt game, raise families, and defend their communities. But despite the ubiquity throughout human history of teams and groups working together to achieve common goals, the scientific study of teams is relatively nascent. In particular, research on how to select candidates for team-based jobs has been limited. This may be, in part, because the teamwork construct space is poorly defined. To address this problem, Stevens and Campion (1994) reviewed the extant team- and group-behavior literatures and generated a taxonomy of 14 team-related knowledge, skills, and abilities (KSAs) reflecting two higher-order teamwork dimensions (interpersonal and self-management skills). Based on this taxonomy, Stevens and Campion (1999) created the Teamwork KSA Test. Despite initial optimism about the scale's properties, in-depth evaluation demonstrated inadequacies in both construct validity and psychometric properties The research presented here addresses these problems in two separate studies. Study 1 used an online sample of 600 respondents to develop a new 15-item measure of teamwork, the Team KSA Test (15-TKT). Scale-development best practices, including item analysis and CFA, were used. Results suggested the general teamwork construct domain was best represented by two separate but related measurement models, one measuring interpersonal skills and the other measuring self-management skills. Model fit was excellent for a three-factor solution of interpersonal skills [SRMR = .04; CFI = .98; GFI = .97] and for a one-factor solution of self-management skills [SRMR = .02; CFI = .99; GFI = .98]. Internal consistency reliability estimates for the 15-TKT were excellent (α = .92). Study 2 was conducted to test the criterion-related validity of the new scale. Using convenience sampling, participants were recruited from a large West Coast government organization. Specifically, 27

team members, including five team supervisors representing five different team types, were recruited. Team members completed an online version of the 15-TKT scale. Team supervisors rated the team performance of each team member using an individual team-performance rating scale. Multiple regression analyses were conducted to predict teamwork performance from interpersonal and self-management skill scores of the new 15-TKT. Results were non-significant (R^2 = .08, F(2,19) = .473, p = n.s.). These findings offer no support for the criterion-related validity of the new 15-TKT scale. Potential reasons for the non-significant finding are discussed. The sample size for Study 2 was small and therefore the study likely lacked sufficient power to detect extant effects. Problems with range restriction in the dependent variable likely increased the possibility of Type II error. Overall, results from Study 1 were promising because they represent the first empirical evidence supporting measurement models related to Stevens and Campion's (1994) teamwork KSA taxonomy. Future research conducted with adequate sample sizes and better criterion measures are needed to assess the criterion-related validity of the 15-TKT.

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Teams of people working together for a common purpose has been a centerpiece of human social organization since our ancient ancestors first banded together to hunt game, raise families, and defend their communities. Despite the ubiquity of teams and groups working together to achieve common goals throughout human history, the scientific study of teams is relatively nascent. In particular, research on how to select candidates for team-based jobs has been limited. This may be, in part, because the teamwork construct space is poorly defined. To address this problem Stevens & Campion (1994) reviewed the extant team and group behavior literatures and generated a taxonomy of fourteen team-related knowledge, and skills (KSAs) reflecting two higher-order teamwork dimensions (interpersonal and self-management skills). Based on this taxonomy, Stevens & Campion (1999) created the Teamwork KSA Test. Despite initial optimism about the scale properties, in-depth evaluation of the scale demonstrated construct validity and psychometric inadequacies. The current research addressed these problems in two separate studies. Study 1 used an online sample of 600 respondents to develop a new 15-item measure of teamwork, the Team KSA Test (15-TKT). Scale development best practices, including item analysis and CFA were used. Results suggested that the general teamwork construct domain was best represented by two separate but related measurement models; one measuring interpersonal skills the other measuring self-management skills. Model fit was excellent for a three factor solution of interpersonal skills [SRMR=.04; CFI=.98; GFI=.97] and for a one-factor solution of self-management skills [SRMR=.02; CFI=.99; GFI=.98]. Internal consistency reliability estimates for the 15-TKT were excellent ($\alpha = .92$). A second study was conducted to test the criterion-related validity of the new scale. Using convenience sampling, participants were recruited from a large west-coast government organization. Specifically, 27

team members including five team supervisors representing five different team-types were recruited. Team members completed an online version of the 15-TKT scale. Team supervisors rated the team performance of each team member using an individual team performance rating scale. Multiple regression analyses were conducted to predict teamwork performance from interpersonal and self-management skill scores of the new 15-TKT. Results were non-significant (R^2 = .08, F(2,19) = .473, p = n.s.). These findings offer no support for the criterion-related validity of the new 15-TKT scale. Potential reasons for the non-significant finding are discussed. The sample size for study 2 was small and therefore the study likely lacked sufficient power to detect extant effects. Problems with range-restriction in the dependent variable likely increased the possibility of Type-II error. Overall, results from study 1 were promising because they represent the first empirical evidence supporting measurement models related to Steven's and Campion's (1994) teamwork KSA taxonomy. Future research conducted with adequate sample sizes and better criterion measures are needed to assess the criterion-related validity of the 15-TKT.

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Chapter 1 - General Introduction

People working together in teams for a common purpose has been a centerpiece of human social organization since our ancient ancestors first banded together to hunt game, raise families, and defend their communities. Indeed, as noted by Cannon-Bowers and Bower (2011), human history is largely a story of people working together in groups to explore, achieve, and conquer.

Despite the ubiquity throughout human history of teams and groups working together to achieve common goals, the scientific study of teams is relatively nascent. Most current researchers agree that the systematic study of teams began in the 1920s and ’30s, around the time of the Hawthorne studies that were conducted at the Chicago Western Electric plant (Sundstrom, McIntyre, Halfhill, & Richards, 2000). Since then, team researchers and practitioners have made much progress. How teams are defined and what effective teams do, think, and feel is well understood, as are team dynamics and interventions to improve teamwork (Bell, Brown, Colaneri, & Outland, 2018; Frazier, Fainshmidt, Klinger, Pezeshkan, & Vracheva, 2017; Hughes et al., 2016). Factors associated with well-functioning teams have been explicated. They include team composition, team leadership, role clarity, mutual trust, quality information-exchange processes, and having a clearly defined purpose (Marlow, Lacerenza, Paoletti, Burke, & Salas, 2018; Wang, Waldman, & Zhang, 2014). Researchers understand that effective teams self-correct; are adaptive, flexible, and cohesive; and that they share mental models of their task, objectives, and fellow teammates (DeChurch & Mesmer-Magnus, 2010; Driskell, Salas, & Driskell, 2018).

Despite an impressive accumulation of knowledge about various aspects of team functioning, much less is known about measuring team processes or how to develop valid selection instruments for personnel selection systems for teams (Baker & Salas, 1992; McClough

& Rogelberg, 2003). Little has changed since Dyer (1984) noted that measures of team processes and predictors of performance are unreliable, overly complex, and lack sensitivity toward team-relevant constructs.

Despite the relatively small amount of research attention given to the measurement of team processes in general and team selection specifically, some progress has been made in this area. For example, Bell (2007) used meta-analytic techniques to explore the relation of collectivist orientation (i.e., preference to work in a group versus alone) to team performance and found positive correlations with modest effect sizes. Barrick and Mount (1991) and Kozlowski and Ilgen (2006) investigated how various dimensions of personality relate to team performance and found trait agreeableness to be an important predictor.

One of the most promising research programs in this area was that of Stevens and Campion (1994, 1999). They exhaustively reviewed the extant literatures on team behavior and created a taxonomy of 14 team-related knowledge, skills, and abilities (KSAs) organized into two higher-order teamwork dimensions. Based on this taxonomy, they also created an assessment tool for team selection called the Teamwork KSA Test. Initial findings suggested that the Teamwork KSA Test was a solid instrument that could be used for team selection. However, a deeper and more critical evaluation of the scale (O'Neill, Goffin, & Gellatly, 2012) demonstrated serious problems with both the scale's overall construct validity and psychometric properties. Work is needed to improve the operationalization and measurement of the original Stevens and Campion (1994) team KSA taxonomy. Thus, the current research addresses this need by developing a more reliable and valid scale to measure the KSAs defined by Stevens and Campion (1994).

The remainder of this dissertation is organized as follows: First, the importance of teams to organizations is discussed and key findings about the benefits of teams to both individuals and organizations are presented. Next, a brief history of work-group research is articulated. General themes are identified, as are themes most germane to the current research. Next, how researchers have approached (and struggled with) selecting members for teams and the importance of team composition are discussed. The discussion then turns to proposed models for teamwork selection, including an in-depth description of a theoretically based taxonomy of knowledge, skills, and abilities thought to be positively associated with teamwork performance. The final sections include study methods and discussion.

Chapter 2 - The Importance of Teams in Organizations

A substantial body of research underscores the importance of teams in organizations. This importance is seen in both the ubiquity of team use and in research findings supporting the association of teamwork with important organizational variables and individual outcomes. According to a recent Deloitte survey of more than 7,000 employees in 130 countries, teamwork is the number one global workforce trend (Kaplan, Dollar, Melian, Van Durme, & Wong, 2016) Research is also demonstrating that teams are being applied to a variety of contexts. For example, Wuchty, Jones, and Uzzi (2007) cite evidence showing that teams are used in construction, information systems, research and development, manufacturing, education, healthcare, science, and telecommunications. Teamwork is considered an important success factor in space exploration, as seen in the recent push for teamwork research to support future missions to Mars (Salas et al., 2015). An older cross-industry survey of United States workers indicated that 80% of workers were members of at least one organizational team and that this trend was likely to increase as environmental complexities continue to increase (Fiore, Salas, & Cannon-Bowers, 2001).

Team-based forms of organizing are not just widely used within organizations, they also have tangible benefits to both organizations and individuals. Research supports associations between team approaches and measures of both organizational efficiency and quality (Applebaum & Batt, 1994). Teams enable development of skill diversity, expertise, rapid-response capability, and adaptability (Kozlowski, Gully, Nason, & Smith, 1999). They facilitate the accomplishment of work in organizational contexts that require flexibility and complex decision-making (Hoerr, 1989), and the use of teams in organizations is associated with

increased productivity and innovation (Katzenbach & Smith, 1993; West, Borrill, & Unsworth, 1998).

Research also suggests that teamwork is associated with the development of skill diversity in organizations, expertise development, adaptability, and the ability to respond rapidly to a variety of exigent factors (Kozlowski et al., 1999). Teams also benefit organizations by creating greater potential for creativity and productivity than any one individual can offer (Gladstein, 1984; Hackman, 1987) and by improving innovation and comprehensive thinking about complex organizational problems (Sundstrom, DeMeuse, & Futrell, 1990). In sum, teamwork is simply more effective in accomplishing many organizational goals than are individuals alone (Horwitz, 2005).

Team approaches also benefit individuals. Work by Applebaum and Batt (1994) showed associations between use of teams and the likelihood of job enhancement, autonomy, and skill development. Thurow (1983) showed that the use of teams is associated with increases in employee engagement and workforce participation. Whyte (1955) argued that working in teams helps satisfy employees' social needs. Stewart and Barrick (2000) presented data supporting the association of teams and employee satisfaction, adaptation, and organizational commitment. Finally, a review by Kozlowski and Bell (2013) presented findings that show teamwork is associated with employee skill, expertise, and experience development, as well as with employee creativity, invention, and innovation.

Given teamwork's ubiquity of use, its association with important organizational variables, and the benefits teams can have for individual employees, an important question facing organizations is how the human-resource function can support and facilitate the development and use of teams within organizations. Of particular importance to the current

research are identifying criteria that human-resource organizations can use to select job applicants for team-oriented work, a topic elaborated on in later sections of this manuscript. However, before delving into research on team selection, a brief discussion about the history of team research will help to situate the current research in its historical context.

Chapter 3 - A Brief History of Team Research

A discussion about the history of team research is important because it helps situate the proposed research within a rich context of work that has developed over the years. In this section, several themes and research trends are discussed. Some of themes are mentioned primarily to illustrate the evolution of thinking about teams; others are described because they serve as a foundation for the current research.

The Hawthorne studies conducted in the early 1900s are considered by many to represent the origin of team research (Sundstrom et al., 2000). The initial objectives of the work were to identify the impact of physical working conditions (e.g., lighting on the manufacturing floor) on worker productivity. However, unexpected findings from the Bank Wiring Room Observation (Homans, 1950) led the researchers to expand their emphasis to include interpersonal dynamics of workers.

In the Bank Wiring Room Observation study, small teams comprised of three wiremen and a solderer worked on wiring projects in a special room that was setup for observation. The study's main purpose was to test whether different lighting conditions impacted worker productivity. Unrelated to study objectives, researchers noticed that two informal social groups emerged from the larger group, each demonstrating distinct behaviors. One group conversed and debated among themselves, played betting games, and maintained consistently high output (relative to production standards); the other group engaged in maladaptive work behaviors (pranks, trading jobs) and policed themselves to only produce up to the set standards (Homans, 1950). The findings set the stage for future team-related research questions. For example, how and why do informal workgroups form? What factors are associated with informal group

productivity levels? Why do informal work groups enforce high versus low production standards? These questions and others became the seeds for future research on group behavior.

Despite the findings of the Hawthorne studies, most organizations through the end of World War II ignored the use of work groups. Instead, organizations favored specialized, narrowly defined jobs for individuals as articulated by the dominant work paradigm of the day, Taylor's "Scientific Management." Scientific Management advocated that work should be designed for maximum efficiency based on scientific principles and that individual human workers would be optimally motivated by financial incentives alone (Blake & Moseley, 2011). Despite its undeniable impact, by the mid 1900s, management writers like McGregor (1960) and Likert (1961) began to criticize Scientific Management as mechanistic and authoritarian, as well as for dehumanizing the workplace (Sundstrom et al., 2000). They started calling for more participation in decision making by frontline workers and for the use of work teams and groups.

By the 1970s, large organizations began publishing research supporting the use of work groups. General Motors used assembly teams in one of its truck factories (Tichy, 1976). General Foods adopted work teams in one of its plants in Topeka, KS (Walton, 1977). Volvo created and launched its now-famous group-based manufacturing plant in Kalmar, Sweden (Dowling, 1973), and Saab used team-based groups in one of its engine manufacturing plants (Katz & Kahn, 1978). Momentum was building—organizations were increasingly using teams to accomplish a variety of work types.

Throughout the 1980s, the application of work groups within organizations continued to grow and spread. Manufacturing companies experimented with total quality management (TQM) and other organizations tried "quality circles" (small groups of employees tasked with thought experiments about how to solve various business problems) to help improve performance and

reduce error. For example, Lockheed Martin, Ford Motor Company, and Martin Marietta experimented with quality circles, often with limited success (Adam, 1994; Banas, 1988; Ledford, Lawler, & Mohrman, 1988; Thompson, 1981).

By the mid 1980s, management researchers described the central use of work groups by organizations as a management transformation, a paradigm shift, and as a corporate renaissance (Kanter, 1983; Ketchum, 1984; Peters, 1988; Walton, 1985). In line with this paradigm and momentum shift, a veritable explosion of empirical research on teams occurred in the decades that followed and continues to this day (for exhaustive reviews of teams research from the past several decades, see Guzzo & Dickson, 1996; Ilgen, 1999; Kozlowski & Bell, 2002; McClough & Rogelberg, 2003; Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017). Researchers explored and continue to explore complex topics such as team effectiveness models (Salas, Stagl, Burke, & Goodwin, 2007), team-based decision-making and shared mental models (Cannon-Bowers & Salas, 1998; Schlechter, Zaccaro, & Burke, 1998), team research methodologies (Kozlowski & Bell, 2002; McIntyre & Salas, 1995; Brannick et al., 2005), team performance theories (Ilgen, Hollenbeck, Johnson, & Jundt, 2005), and temporal aspects of team functioning and performance (Salas, Reyes, & McDaniel, 2018).

In addition to the broad and varied team-related research inquires described above, several research themes from past decades are foundational to the current research. First, and perhaps most importantly, researchers in the past decades reached general consensus about the operational definition of a "team." Researchers agree that a team is characterized by (a) two or more individuals who (b) interact socially, (c) share common goals, and (d) who work together to perform tasks relevant to the organization (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) who have different roles and responsibilities; and (g) who are

embedded in an organizational system, with boundaries and linkages to the broader context and environment (Salas et al., 2018). Thus, in the current research, teams are recruited for study participation that meet the requirements of this functional definition.

Second, and related to operationally defining teams, team taxonomies have been articulated. Taxonomy development is a critical part of scientific research because it serves to define and classify "like" elements into groups that facilitates the ability to explore and to make general inferences about the group (Fleishman & Quaintance, 1984). Those general inferences lead to heuristics development that can simplify decision making tasks about the groups. Researchers over the past decades have made many efforts at classifying teams. Several of these taxonomies have focused on classifying the types of teams typically found in organizations (Cannon-Bowers, Oser, & Flannigan, 1992; Cohen & Bailey, 1997; Devine, 2002; Hackman, 1990; Sundstrom et al., 1990, 2000b). Salas et al. (2005) highlights three such taxonomies that have been of significant benefit to the development of team science.

Kozlowski et al. (1999) extended previous taxonomic efforts by identifying how various contextual factors can impact team type. Their work posits that teams can be distinguished from one another based on five characteristics: tasks, goals, roles, process emphasis, and performance demands.

Devine (2002) further refined taxonomic efforts by devoting more attention to teams involved in day-to-day operations and by clarifying contextual factors that likely drive team development. His work denotes 14 team types differentiated by seven contextual variables.

Finally, Sundstrom et al. (2000) argued for the existence of six distinct types of teams: production teams, service teams, management teams, project teams, action/performance teams, and parallel teams. The distinguishing characteristics of each team type can be extrapolated

based on their degree of specialization and autonomy, their degree of integration with the system outside of the team, and by the length and novelty of the work cycle. *Production teams* are characterized by core employees who consistently and over time produce tangible products (e.g., road construction crews). *Service teams* participate in repeated transactions with customers whose needs vary (e.g., customer service representatives), thus making the nature of the transactions variable. *Management teams* are characterized by senior managers responsible for directing and coordinating lower-level units (e.g., executive staff over different divisions of a human resources department). *Project teams* are time-bound teams that execute on specific tasks and then disband (e.g., software developers working on a new product). *Action and performance teams* are characterized by interdependent groups of experts who participate in complex performance tasks (e.g., military units).

Because no consensus yet exists about which team taxonomy is preferred, and for reasons of parsimony, the current research utilizes only five of the six team types described by Sundstrom (parallel teams are excluded because the government organization in which the current research was conducted does not utilize this type of team) as a framework for exploring the relation between teamwork skills and successful team-member performance by team type. A central proposition of the current research is that generic teamwork skills exist and are associated with individual team behaviors regardless of the type of team in which they are performed. More is said about this in later sections of this manuscript.

In the past few decades, research on team composition has emerged. Generally speaking, team composition research has focused on the configuration of team member attributes in a team (Levine & Moreland, 1990) and their relation to team processes and outcomes (Bell, 2007). Emphasis in this body of research has differentiated between surface-level and deep-level

attributes. Surface-level attributes refer to overt demographic characteristics of individuals that can be ascertained by fellow teammates relatively accurately after brief exposure. These characteristics include age, race, gender, education level, and tenure within an organization. Deep-level team composition attributes refer to characteristics such as personality factors, attitudes, and KSAs. These factors, obviously, are less easy to accurately ascertain without some kind of formal testing.

Not surprisingly, results from empirical research on the relation between surface-level versus deep-level characteristics and team performance has been varied. Meta-analytic study results suggest no consistent relation between surface-level characteristics and team performance (Bell, 2007); empirical results on deep-level team characteristics has been more promising. Overall research findings suggest a modest relation between certain deep-level team composition variables and team performance, but with some inconsistencies. Details of this research are discussed in more detail below, but summarily, Bell (2007) and colleagues meta-analytically evaluated the relation between team performance and five factor model (FFM) personality factors, attitudes, and general mental ability. They found small to moderate associations between team performance and many of the deep-level team composition constructs.

Another area of research exploring deep-level team characteristics has focused on identifying and exploring relations between effective team member performance and team-related KSAs. Three research efforts in this area are noteworthy and salient to the current work. Smith-Jentsch, Zeisig, Acton, and McPherson (1998) investigated the characteristics of successful teamwork in the military and found support for a four-component model of teamwork: information, communication, supporting behavior, and team leadership. Subsequent research of

the model demonstrated both convergent and discriminant validity, and that the model discriminated between expert and novice teams.

Another research initiative by Salas and Cannon-Bowers and colleagues (Salas, Burke, & Cannon-Bowers, 2000) posited but did not test that KSAs related to effective teamwork may be accounted for by eight dimensions: adaptability, shared situational awareness, performance monitoring, team leadership, interpersonal relations, coordination, communication, and decision-making.

By far the most comprehensive and promising research conducted in this area was done by Stevens and Campion (1994). Their exhaustive review of the teams and group dynamics literatures resulted in a delineation of 14 specific KSAs that are posited to be important for teamwork regardless of context or team type. Ten of the 14 specific KSAs are related to interpersonal skills and tap into characteristics including communication skills, conflict resolution skills, and collaborative problem-solving skills. The remaining four KSAs are related to self-management skills and tap into characteristics including utilization of goal-setting skills, and performance-management techniques. Each specific KSA and why it is important for teamwork is described in detail below, but at even a cursory level, the framework is logical. It is reasonable to expect that good "team players" know how to communicate openly and effectively, have effective conflict-resolution skills, and know how to problem solve as part of a group versus in isolation. Similarly, it is reasonable to expect that effective team members are able to establish meaningful goals for themselves and teammates and that they are capable of managing performance relative to those goals. These characteristics should be relevant for team members participating in team-based work regardless of the type of work their team performs.

The Stevens and Campion model (Stevens & Campion, 1990) is the most clearly defined and well-operationalized, and thus serves as an optimal foundation for the current research. However, a cursory look at the models shows considerable conceptual overlap. For example, all models mention (or infer) the importance of communication, goal-directed behavior/leadership, and performance monitoring as crucial skills for effective teamwork. This consensus adds to the credibility of the overall argument made in the current research, that certain teamwork skills are important for all kinds of work performed by teams. This work (specifically the work from Stevens and Campion) is described in more detail below, but is highlighted here because it serves as the theoretical foundation of the current research.

In summary, as evidenced by the incredible volume of teams research generated since the Hawthorne studies of the early 1900s, teams are important and likely will remain central in organizational life for years to come. In this section, some general themes and trends were highlighted that mostly serve to situate the current research within the landscape of a larger body of team research. Work foundational to the current research was also highlighted. First, the consensus team researchers have reached about the definition of a team was discussed. The significance of this progress cannot be overstated. Without consensus on the conceptual definition of a team, research progress languishes because scholars lack a consistent and unifying framework in which to work. Based on this work, a team is characterized by (a) two or more individuals who (b) interact socially, (c) share common goals, and (d) who work together to perform tasks relevant to the organization (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) who have different roles and responsibilities; and (g) who are embedded in an organizational system, with boundaries and linkages to the broader context and environment. This definition of a team is being used in the current research.

Second, work describing various team taxonomies was discussed. Given that no consensus exists in the literature about which team taxonomy is preferred, and for reasons of parsimony, the current research utilizes a simple team-type taxonomy proposed by Sundstrom, McIntyre, Halfhill, and Richards (2000) which includes six team types: production teams, service teams, management teams, project teams, action/performance teams, and parallel teams. The distinguishing characteristics of each team type can be extrapolated based on their degree of specialization and autonomy, their degree of integration with the system outside of the team, and by the length and novelty of the work cycle. The current research tests, in part, whether successful teamwork differs based on these team types.

Finally, work on team composition was discussed. Research efforts to identify personality, attitudinal, and ability variables that consistently predict team performance were shown to be only marginally successful, with low to moderate effect sizes found in field studies. Team composition research that emphasizes teamwork skills was described. In particular, the overlap between models from three independent research labs was highlighted, noting that all three include communication, goal-directed behavior/leadership, and performance monitoring as crucial skills for effective teamwork. Stevens and Campion's (1994) work is utilized as the basis for the current research because the level of operationalization is more detailed and precise. Their model posits that specific interpersonal and self-management skills are important for effective teamwork. Interpersonal skills described include communication, conflict resolution, and collaborative problem solving. Self-management skills include utilization of goal-setting and performance management. Specific details explaining why each skill area is important for effective teamwork is described below in considerable detail.

Chapter 4 - Team Selection and Generic Teamwork Skills

Insight into how to best select employees for teams has been slow to develop (Allen & West, 2005), however some progress has been made of late. There is a growing recognition that team selection differs meaningfully from individual selection because of the dynamic and interdependent nature of team-oriented work (Zaccaro & Dirosa, 2012). Thus, it follows that team-selection procedures should differ from traditional approaches for selecting individuals into for organizations.

Researchers have identified several critical differences between selecting individuals for team membership and selecting individuals for other types of organizational positions (Zaccaro & Dirosa, 2012). First, team selection must be concerned not only with the requisite KSAs required for taskwork performance, but also with the KSAs for teamwork (Cannon-Bowers & Salas, 1997; Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). Teamwork-specific KSAs likely involve knowledge and skills that promote collaborative performance. Second, the "fit" of individuals within teams is important because effective team performance is the result of combining characteristics of individuals together to create a cohesive whole. Thus, identifying taskwork and teamwork competencies that engender team fit is paramount (Humphrey, Hollenbeck, Meyer, & Ilgen, 2007). A third distinction between individual and team selection is that the candidate pool for team selection is often a mixture of internal and external applicants, frequently with a greater number of internal candidates because organizations do not routinely recruit external candidates to participate in teams for specific projects or tasks. Thus, in team selection, the candidate pools are often smaller and more homogeneous.

A final consideration distinguishing team selection from individual selection involves team formation. As noted by Zaccaro and Dirosa (2012), team formation for a specific task or

project that will be performed in a relatively short period of time has different staffing concerns than a team that will be multifunctional and remain together over a longer period of time. Cannon-Bowers et al. (1995) argued for the importance of identifying "transportable competencies," which are team competencies important for team performance regardless of team type or task. The focus of the current research aligns with this thinking: the first concern in team selection is identifying generic or transportable team member characteristics that enable effective teamwork across team type and context.

Curiously, despite recognition of the importance for team performance, team composition research has received relatively little attention in the industrial and organizational research personnel selection literature. As noted by Mohammed, Cannon-Bowers, and Foo (2010), "Despite a wealth of accumulated knowledge about how to select individuals to fit jobs and a burgeoning team literature, relatively little of this research has systematically focused on team selection issues" (p. 801). The work that has been done, however, shows promise toward understanding the transportable competencies required for effective teamwork. The findings from several research programs are salient to the current work and are described below.

Bell (2007) explored whether an individual's preference for working in teams (versus autonomously) impacted overall team performance. Her meta-analytic findings support the assertion that one's preference for working in teams is positively associated with overall measures of team performance, and the significant association holds (with moderate effect sizes) regardless of team or task type. These findings support the assertion that preference for working in teams may be an important transportable team characteristic.

Researchers have also explored various aspects of personality and how they relate to team performance. Kozlowski and Ilgen (2006) presented evidence suggesting that emotional

stability may be an important transportable characteristic positively associated with team performance. Barrick and Mount (1991) showed that higher levels of conscientiousness may relate to team accountability. Specifically, team members with higher levels of conscientiousness may be more concerned with ensuring successful accomplishment of their role(s) within the team. Various meta-analyses have explored the contribution of transportable personality characteristics to team performance. Stewart (2006) investigated the relation of aggregated personality (based on FFM) to team performance and found medium effect sizes. Mount, Barrick, and Stewart (1998) found that trait agreeableness showed the strongest effect sizes in its relation to team performance. They noted that the true-score correlation between agreeableness and team performance was high (r = .31), suggesting that trait agreeableness may be an important predictor for work that involves cooperation and interdependence between coworkers. Further support for the importance of trait agreeableness in team performance was found by Peeters, van Tuijl, Rutte, and Reymen (2006). They found that high levels of agreeableness were associated with team performance and that high variability in levels of agreeableness among a team negatively impacted performance. Bell (2007), in an exhaustive meta-analysis, found that both mean and minimum levels of agreeableness were significantly associated with team performance. These findings suggest that "one disagreeable member can disrupt the social harmony of the team and subsequently team performance" (p. 603). Based on these findings, it is likely that agreeableness is a transportable competency associated with generic team performance.

Another body of research focusing on the KSA requirements of teamwork rather than personality has also emerged. This work is particularly meaningful because, historically, research has supported more success with KSA-based systems in the prediction of job performance than

with personality-based approaches (Hunter & Hunter, 1984; Reilly & Chao, 1982; Schmitt, Gooding, Noe, & Kirsch, 1984). Further, a KSA-based approach is likely more appealing to organizations because it focuses on characteristics that management can influence (e.g., through training or selection systems) versus more stable dispositional characteristics of individuals (Stevens & Campion, 1994).

Research on individual KSAs that are important for teamwork has been limited. In fact, no (known) meta-analytic data are currently available that speak to average validities associated with various transportable team-level KSAs (Zaccaro & Dirosa, 2012). Of the limited work conducted in this area, several studies are noteworthy. Importantly, while differences exist in the models described here, all have considerable overlap with one another (e.g., all emphasize the importance of conflict resolution, communication, and cooperation) which speaks to a degree of consensus in the literature about the KSAs thought to be important for teamwork.

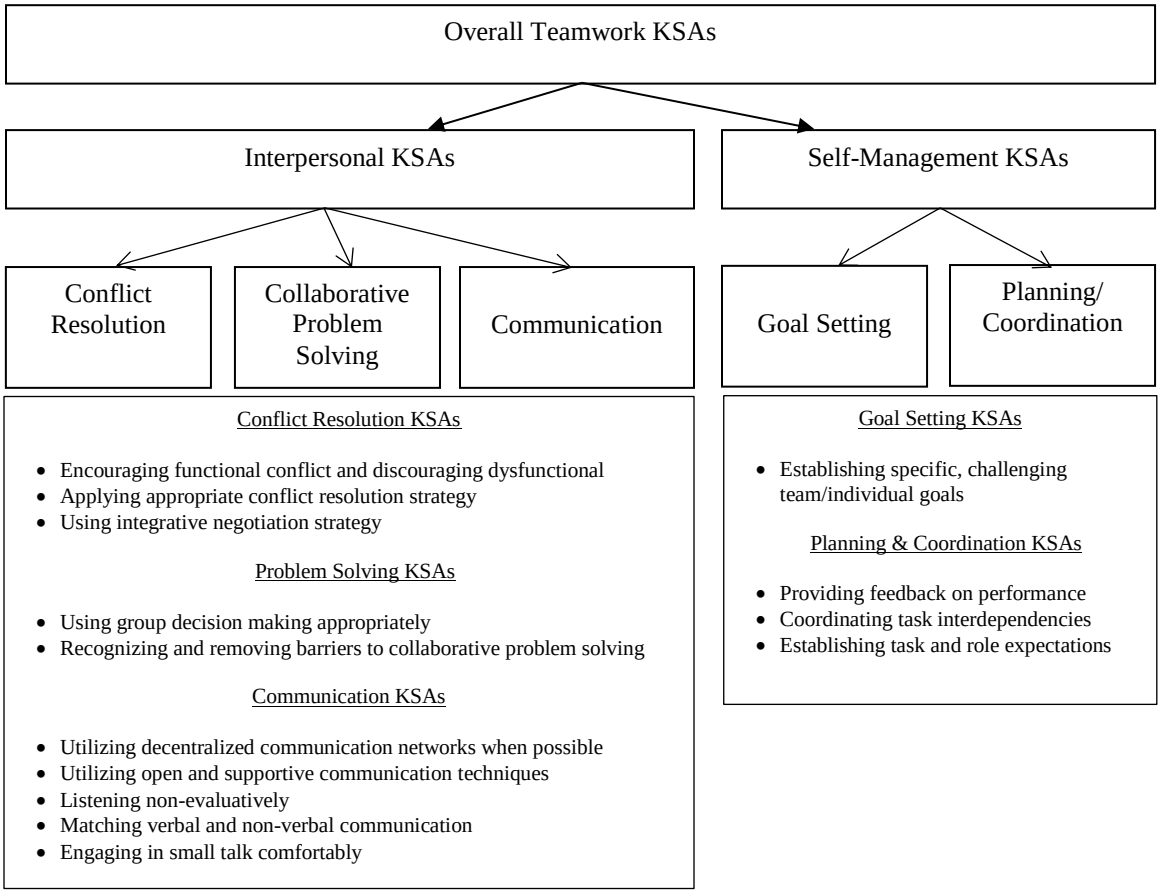
Cannon-Bowers et al. (1995) reviewed the extant team literature to identify KSAs important for team performance. They explicitly differentiated between the KSAs that were context-specific (i.e., dependent upon team or task type, or impacted by situational factors) and those that were transportable across situations. Morgeson, Reider, and Campion (2005) regressed team social skills, coordination, service orientation, and stress tolerance onto team performance and found that each attribute uniquely predicted overall team performance. Finally, Hirschfeld, Jordan, Feild, Giles, and Armenakis (2006) reported that collective knowledge of teamwork was a significant predictor of overall team performance.

Beginning in 1994, Stevens and Campion conducted what is now the most popular and comprehensive work on teamwork KSAs. Their exhaustive review of the team-related research examined relevant theories and findings from a variety of literatures, including those pertaining

to organizational and social psychology, socio-technical theory, and industrial engineering (Stevens & Campion, 1999). However, because these literatures (in most cases) did not explicitly identify individual-level team member KSAs, Stevens and Campion (1999) inferred the KSAs in their model from the various extant group-level and organizational-level constructs. The results of their review suggested a content domain of transportable teamwork KSAs consisting of two higher-order dimensions: interpersonal KSAs and self-management KSAs. These higher-order dimensions of teamwork comprise five subcategories and 14 specific teamwork KSAs. Because the Stevens and Campion (1994) model serves as the basis of the current research, the model and each category are explained below relying heavily on the original 1994 work; see Figure 1.

As mentioned, the taxonomy developed by Stevens and Campion (1994) consists of two main dimensions of teamwork KSAs: Interpersonal KSAs and Self-Management KSAs. Interpersonal KSAs consist of specific knowledge, skills, and abilities that facilitate interpersonal interaction, namely conflict resolution, collaborative problem solving and communication. Self-management KSAs are comprised of goal setting and planning/coordination. The development of the theoretical rationale underlying each dimension is described following Figure 1.

Figure 1. The hierarchy of teamwork KSAs.



Interpersonal KSAs

Effective teams are characterized by amicable interpersonal relationships because pleasant relationships/interactions free team members from the burden of conflict and the processes required to resolve conflict (Hackman & Morris, 1975; Lawler, 1986; Seers, 1989). Friendly interpersonal relationships also lead to engaged and productive participation from team members (Perkins & Abramis, 1990). Varney (1989) refers to this skill as interpersonal competence and defines it as the ability to maintain healthy working relationships and to respond respectfully to teammates' ideas and differing viewpoints.

Lawler (1986) argues that the interpersonal demands associated with working in a team environment are much greater than in traditional individual-based contexts. Working effectively as part of a team requires that each team member be capable of constructive and positive interactions with peers. Hackman and Morris (1975) make the point more explicitly, arguing that the key to team effectiveness is in the ongoing interaction that takes place among group members. Therefore, it is sensible that the need for interpersonal competence is more salient when individuals are working in teams because the number of interpersonal interactions inevitably increases.

When Stevens and Campion published the initial taxonomy, they noted "we have very little systematic knowledge about which interpersonal skills are most desirable" (p. 506). Indeed, one goal of their study was to specify the domain of interpersonal team member capabilities. Their seminal 1994 work identified and proposed three subcategories of interpersonal skills that are important for effective team member functioning: conflict resolution KSAs, collaborative problem solving KSAs, and communication KSAs. The rationale and logical development supporting each subcategory is described below.

Conflict Resolution KSAs

A variety of researchers have identified the skill of conflict management/resolution as an important interpersonal characteristic for team members (Goodman, Ravlin, & Argote, 1986; Levine & Moreland, 1990; Saaverdra, Earley, & Van Kyne, 1993; Sundstrom et al., 1990; Morgeson, 2005; Cannon-Bowers & Bower, 2011). Conflict within a team is not uncommon and can occur for a variety of reasons. For example, team conflict occurs when the actions of a team member or members are not aligned or complementary to the actions of other team members, or when team members hold incongruent goals and believe they cannot be achieved simultaneously

(Levine & Moreland, 1990). Thus, being able to manage conflict and disagreement in a productive way is considered by some to be the essence of interpersonal team skills (Eden, 1985; Varney, 1989).

Research suggests that some team conflict is not only inevitable but that optimal team performance may require moderate levels of it. Without some conflict, there may be no viable way to identify problem areas. In fact, historical researchers (e.g., McGregor, 1960) argued that conflict is not something effective teams avoid or suppress in order to retain surface-level civility. Rather, "when conflict occurs in effective teams, it tends to be constructive, civil, and not personally threatening" (Stevens & Campion, 1994; p. 508).

Other researchers have argued for the positive effects of conflict including reduced stress, communicating dissatisfaction, fostering innovation, and even strengthening and stabilizing relationships (Coser, 1956). Serious negative consequences can occur if conflict is not allowed and managed. For example, Levine and Moreland (1990) and Nemeth and Staw (1989) showed that negative team outcomes like hostility among team members, reduced team performance, and increased likelihood of team dissolution were all positively associated with levels of unresolved team conflict. Based this rationale, Stevens and Campion (1994) argued that conflict is inevitable and should not be avoided; instead conflict should be appropriately managed and leveraged for gain. Thus:

Team KSA 1 - *Recognizing and encouraging functional team conflict and discouraging dysfunctional conflict*

As intimated above, conflict among teams comes in many shapes and sizes; identifying the type and source of conflict is important because different conflicts suggest different resolution strategies. For example, when conflict occurs because of miscommunication among

team members, it can often be resolved using various listening and questioning techniques (e.g., closed-loop communication). If conflict is the result of situational factors (like one team member being stuck performing a mundane or unpleasant task), the situation could be resolved by implementing a rotating assignment schedule (Deutsch, 1973; Holmes & Miller, 1976; Thomas, 1977).

Teams often utilize joint decision-making strategies which can lead to conflict because of differences in teammates' needs, objectives, or perceptions. Forsyth (1990) suggests that this kind of conflict can be managed and eliminated using various techniques. For example, generating and evaluating alternative solutions as a team, searching for common goals, or using open discussion and reason to better understand the perspective of other teammates.

Individual differences in values, attitudes, and/or beliefs can also be a source of conflict within teams. These differences can be navigated by working to increase openness for alternative ideas and feelings and by willingness to accept differences in others (Bass, 1980). Several specific techniques can help—for example, sensitivity training, individual counseling, and even role analysis to help clarify expectations, etc. (Kaplan, 1986; Schaubroeck, Ganster, Sime, & Ditman, 1993; Schein, 1969). Therefore:

Team KSA 2 – *Recognizing the type and source of conflict and implementing an appropriate conflict resolution strategy*

Teammates can periodically reach an impasse situation that requires negotiation skills to resolve it. Traditional negotiation tactics are based on the premise of mutual compromise in which neither party gets all of what they what. However, more current strategies emphasize collaboration to find strategies that satisfy the needs of both parties. The traditional strategy is

referred to as distributive (or win-lose) bargaining while the latter is referred to as integrative (or win-win) bargaining (Lewicki & Litterer, 1985).

Stevens and Campion (1994) make a strong argument for integrative negotiation knowledge and skills (and against distributed bargaining) being an important team KSA. Integrative bargaining likely facilitates team cohesion over time because it is based on openness and trust among team members and because it emphasizes finding the best possible solution to a problem. This is in contrast to the distributive approach in which the outcome is typically characterized by one "winner" and one "loser." Over time, in a team context, this style would likely engender perceptions of manipulation, deceptiveness, and mistrust which may make teammates less willing to work together in the future. This obviously could lead to deterioration in team cohesion and ultimately effectiveness. Hence:

Team KSA 3 – *Employing an integrative negotiation strategy and avoiding distributive approaches*

Collaborative Problem Solving KSAs

The second subcategory of interpersonal KSAs posited as important for teamwork is collaborative problem solving. The problem-solving demands placed on employees in work teams exceed those found in individual-based systems because in most circumstances, all team members are expected to participate in collaborative problem solving (Stevens & Campion, 1994). The critical issue in collaborative problem solving is to know when to collaborate and when to simply make an individual decision. Research suggests that group decision-making regularly outperforms individual decision-making, especially when faced with solving a problem that has one best answer. Group decision processes usually result in multiple perspectives brought to bear on the problem which, in turn, can lead to improved diagnosis, more possible

solutions considered, and an increased possibility that correct decisions will be parsed from wrong ones (Laughlin & Ellis, 1986; Laughlin & McGlynn, 986; Levine & Moreland, 1990). This process of team deliberation and deciding is called disjunctive decision-making (Steiner, 1972). Effective team members should have the capability to engage the team in problem solving discussions, soliciting input from members to ensure all perspectives are considered, and adopting a solution only when decisions are supported by satisfactory logic and reasoning.

Team decision-making is desirable for several reasons. First, it often leads to greater acceptance, ownership, and commitment relative to the decision. Also, group decision processes are associated with greater team cohesion, team interdependence, and with alignment of team objectives (Forsyth, 1990; McGrath, 1964). Further, a substantial volume of decision-making research suggests that group decision-making often increases the availability and amount of decision-relevant information (Guzzo, 1986; Guzzo & Waters, 1982; Janis, 1982; Miner, 1984; Tjosvold & Field, 1983).

However, group decision-making is not always the best strategy. Teams should decide on the level of participation required in decision-making based on factors like the significance of error, the importance of team acceptance, the simplicity of the decision, and the capability of the team members (Vroom & Jago, 1978). In many situations, individual decision-making is the appropriate course of action. The key is for team members to understand when participative decision-making is needed and when it is not. Thus:

> Team KSA 4 – *Identifying situations requiring group decision-making and using the proper degree and type of participation*

Group decision-making and problem solving is not without its challenges. Research has shown the powerful (and often negative) effects of groupthink and conformity (Asch, 1955;

Janis, 1982). Groupthink can occur when critical thinking and evaluation is superseded by the desire for group harmony resulting in poorer-quality decisions. Conformity can occur when group members exert pressure on other group members to comply with majority opinions. The best team members are able to help their teams recognize and avoid these kinds of problems using the various strategies and techniques (e.g., brainstorming, nominal group, Delphi technique, group voting, stepladder, etc.; Levine & Moreland, 1990). Therefore:

Team KSA 5 – *Recognizing the obstacles to collaborative problem solving and implementing the appropriate corrective actions*

Communication KSAs

Beyond conflict resolution and collaborative problem solving KSAs, a final subcategory of interpersonal KSAs important for team functioning in the Stevens and Campion (1994) model is communication. Early researchers understood the importance of effective communication on team processes and outcomes (e.g., Leavitt, 1951), and contemporary researchers recognize its importance as well (Driskell, Salas, & Driskell, 2018; Kozlowski & Chao, 2018; Campion, Medsker, & Higgs, 1993; Gladstein, 1984; Pearce & Ravlin, 1987). However, there is much more to effective communication than simply being able to hold an amiable conversation with others. Effective communication involves communication networks, communication styles, listening skills, effective nonverbal communication, and small talk/ritual greetings. Each is discussed below as important parts of being an effective team member.

The setup of communication channels (networks) among team members can have a substantial impact on how well the team performs. Research has explored a variety of different communication network setups in terms of how fast and accurate information is transmitted, the extant information is distributed among members, and how satisfied team members are with the

setups. Generally speaking, decentralized communication networks are best for teams—they create fewer bottlenecks, members stay better informed, and team members express more satisfaction (Shaw, 1981). Stevens and Campion (1994) correctly note that team members do not always control the setup of communication networks within their organizations. Nonetheless, it is beneficial for team members to understand decentralized communication networks so they can implement them where possible. Hence:

Team KSA 6 – *Understanding communication networks and utilizing decentralized networks where possible*

Communication style is also important for effective team functioning. Research suggests that the most effective teams enjoy an informal and relaxed communication style with no apparent tensions. In these teams, members are open and receptive to the ideas and feelings of others and consider perspectives other than their own. Members are willing to ask questions without fear of repercussion. A result of this communication style is that relevant and important issues are consistently and effectively discussed (Argyris, 1966; Likert, 1961; McGregor, 1960).

This open communication style has several specific characteristics. First, open communication is behavior-focused and not person-focused. Specifically, the communication focuses on the characteristics of the problem and not on the individual, it is specific not general, and it is descriptive rather than evaluative, making comparisons to objective (versus subjective) standards. Second, according to work by Rogers (1961), open communication is characterized by a congruence between what the communicator feels and says. This matching of verbal and nonverbal cues leads to enhanced trust (and therefore effectiveness) of the communication. Third, open communication is validating of other individuals. Messaging that engenders negative feelings about self-worth, identity, etc. is invalidating and much less effective. Fourth, open and

effective communication is conjunctive—i.e., concerned with ensuring that everyone has an equal opportunity to speak and no one team member monopolizes the conversation. Finally, in effective open communication, communicators take responsibility for their words and acknowledge themselves as sources of ideas where applicable. These communication skills take work and time to develop and are an important aspect of being an effective team member. Therefore:

Team KSA 7 – *Communicating openly and supportively focusing on behavior, being congruent, being validating, being conjunctive, and taking ownership*

Listening is an extremely important part of effective communication and is also a hallmark characteristic of high-performing teams (Luthans & Larsen, 1986). A key characteristic of good listening is that listeners listen non-evaluatively and without rendering judgment (either positive or negative). True listening can be challenging because individuals tend to constantly, chronically, and very rapidly evaluate what they hear.

Techniques exist to improve listening skills. For example, individuals can practice probing for information or reflecting back to the communicator, or even by deflecting which involves relating analogies and examples related to what is being said. Thus:

Team KSA 8 – *Listening non-evaluatively and using active listening techniques*

A third aspect of good communication involves nonverbal skills. A host of research underscores the importance of nonverbal communication (Driskell, Olmstead, & Salas, 1993; McCaskey, 1979; Mullen & Driskell, 1989; Ridgeway & Diekman, 1989; Williams, 1989). In fact, some research suggests that nonverbal communication can trump verbal in certain situations (DePaulo, Resenthal, Eisenstat, Rogers, & Finkelstein, 1978; Harrison, Hwalek, Raney, & Fritz, 1978). Several different types of nonverbal communications exist and are used regularly—for

example, vocal features such as how loudly or how quickly one speaks, facial expressions and gestures, physical touch such as shaking hands or patting on the back, and the timing of communication (e.g., making someone wait to speak with you). Effective team members should be aware that these subtle mannerisms can either reinforce or undermine verbal communication. However, consciously controlling nonverbal can be challenging and result in communication that comes across stilted or artificial. To maximize the likelihood that verbal communication matches nonverbal, individuals should focus on congruence as mentioned above (Buck, 1984). Hence:

Team KSA 9 – *Maximizing consonance between verbal and nonverbal messages and recognizing and interpreting the nonverbal messages of others*

Small talk and ritualized greetings can also serve the function of acknowledging the presence and value of others. Thus, the use of even inane conversation between team members can strengthen interpersonal team relationships. Effective team members should be able to effectively banter and use small talk when appropriate. Thus:

Team KSA 10 – *Engaging in small talk and ritual greetings*

In sum, according to Stevens and Campion's (1994) taxonomy of team KSA skills, there are ten fundamental interpersonal KSAs that should be related to effective functioning within a team. Their model also included a second performance dimension, characterized by self management–related KSAs. These KSAs are discussed below.

Self-Management KSAs

Teams in organizations often are afforded substantial control over the direction and execution of specific tasks (Cannon-Bowers et al., 1992; Hackman, 1986). Thus, the ability of teams to self-manage becomes of central import.

Implied in suggesting that teams self-manage is the notion that team members have the knowledge and skills to perform some essential managerial tasks. The Stevens and Campion (1994) model includes two subcategories of self-management KSAs that team members should possess in order to contribute to effective self-direction of teams. The first subcategory includes goal setting and performance management KSAs, the second, planning and task coordination KSAs. Each are explained below.

Goal Setting and Performance Management KSAs

Goal setting is a well-established technique for managing individual performance (Locke & Latham, 2002). Similarly, a clearly defined purpose for team functioning is central for team effectiveness. This has been argued conceptually (Gladstein, 1984; Hackman, 1987; Larson & Schaumann, 1993; Shea & Guzzo, 1987; Sundstrom et al., 1990) and supported empirically (Buller & Bell, 986; Koch, 1979; Pearson, 1987; Weingart, 1992; Weldon, Jehn, & Pradhan, 1991).

How difficult a team goal is relative to the team's ability is central in determining team performance. Research suggests that team success is a product of the proper choice of task difficulty. Conversely, team failure follows from the opposite: goals that are too difficult (Kukla, 1975). Thus, team goals must be both challenging and attainable in order to be maximally effective.

Research has also shown that goal acceptance among team members is important for maximizing team performance. Additionally, goal acceptance at the team level is particularly important because there can be conflict between goals at the individual and team levels. This lack of clarity can negatively impact overall team effectiveness (Larson & LaFasto, 1993). Goal

acceptance can be enhanced by using techniques like participatory goal setting in which team members are actively involved in defining their own goals. Therefore:

Team KSA 11 – *Establishing specific, challenging, and accepted team goals*

Given the dynamic nature of teams, performance monitoring and feedback are also important for effective team functioning. Long-term team viability depends on the team's ability to self-monitor performance over time and to develop effective feedback loops so they are able to make adjustments as needed (Goodman & Dean, 1982; Weingart, 1992). Similarly, individual performance should be monitored to avoid common group phenomena like social loafing. The overall team function benefits when each individual performance can be clearly linked to team performance (Albanese & Van Fleet, 1985; Harkins, 1987; Levine & Moreland, 1990). Consequently:

Team KSA 12 – *Monitoring, evaluating, and providing feedback both on team and individual member performance*

Team functioning is highly dependent on the coordination of team activities. Research has shown that planning and task coordination activities are associated with increased team effectiveness (Oser, McCallum, Salas, & Morgan, 1989; Weingart, 1992). Given that integrating the activities of team members requires coordination and synchronization, these coordination efforts are considered self-management activities (McClough & Rogelberg, 2003). A main determinant of how much coordination of tasks is needed is the task interdependence among the members. The higher the interdependence, the more coordination is required, but research supports the assertion that some degree of coordination activity is required in all teams (Saaverdra et al., 1993). Thus:

Team KSA 13 – *Planning and coordinating activities, information, and task interdependencies among team members*

Models of team effectiveness often include mechanisms for setting clear expectations about tasks and roles of team members (Eden, 1985; Gladstein, 1984). Related to this are the issues of workload sharing and the fair distribution of work among team members. Limited empirical work has explored the impact of workload distribution strategies, but theoretical models (e.g., equity theory) suggest that equitable distribution of work should be considered when managing workload assignments (Adams, 1965; Leventhal & Scherer, 1987). Therefore:

Team KSA 14 – *Establishing task and role expectations for team members and ensuring team workload balance*

The implications of this explication of teamwork KSAs are numerous for the human resource function in organizations. For example, Stevens and Campion (1994) discuss potential applications of this work to training, performance appraisal, career development, job evaluation, job analysis, and, of course, personnel selection.

With respect to personnel selection, the identification of KSAs that are required by team-oriented jobs is important. As previously mentioned, relatively little research attention has been paid to selection issues for teams. Further, of the scant research that has been conducted, much has focused on dispositional predictors of team behavior. The focus on personality to predict team behavior may have limited benefit. Most work contexts are "strong situations" (Herriot, 1981), meaning that proper behavior is clearly prescribed so people adjust their behavior accordingly regardless of their "natural" personal tendencies (Stevens & Campion, 1994). This may explain why KSA-based predictors historically have shown superior validity over personality (Allen & West, 2005; McClough & Rogelberg, 2003; Stevens & Campion, 1994).

Knowledge and skills are more directly linked to one's ability to perform a job task regardless of the context. Additionally, KSAs are more difficult to fake. It is difficult to imagine a job applicant correctly answering questions about group problem-solving techniques if they do not actually know something about the topic.

Critique of the Teamwork KSA Test

The taxonomy of KSAs developed by Stevens and Campion (1994) lends itself well to the creation and validation of selection procedures to measure the KSAs. Indeed, the future directions section of their paper calls for research to develop selection tools based on their taxonomy. Stevens and Campion (1999) answered this call in developing the Teamwork KSA Test that was designed to facilitate selection of job applicants for working in teams. The Teamwork KSA Test is a 14-item multiple-choice test in which respondents are presented with workplace scenarios and asked to identify the best solution/strategy.

Initial opinions suggested that the Teamwork KSA Test (Stevens & Campion, 1999) held promise for selecting individuals to work in team environments. The test was based on a theoretically developed taxonomy of teamwork capacities (described above) and was widely known and used by organizations for team selection (O'Neill et al., 2012). A Google Scholar search of the original scale development article yielded 428 citations at the time of this writing.

Unfortunately, despite the Teamwork KSA test's high citation count and popularity, very little empirical research speaks to the test's reliability and validity. Extant research suggests only modest overall scale reliability and there have been no reports of subscale reliability coefficients (O'Neill et al., 2012). Further, only inconsistent evidence exists regarding the scale's criterion-related validity (Allen & West, 2005). Stevens and Campion report high criterion-related validity coefficients in the .50 range, but other work suggests potential multicolinearity problems with correlations between the test and measures of employment aptitude ranging from .91 to .99 (Allen & West, 2005). More concerning still is work by both Miller (2001), who examined the relation between Teamwork KSA Test scores and team performance and found no significant relation, and by O'Neill et al., (2012), who assert that no data are available concerning the

scale's factor structure, concurrent or discriminant validity, scale-level reliabilities, or item properties. Details pertaining to the test's reliability and validity are described in detail in the following paragraphs.

Reliability of the Teamwork KSA Test

Of the available research exploring the psychometric properties of the Teamwork KSA Test, only six reported Chronbach's alpha for the overall scale score: McClough and Rogelberg, (2003), α = .59; Leach, Wall, Rogelberg, and Jackson (2005), α = .70; Chen, Donahue, and Klimoksi (2004), α = .64; Martin-Perez, Martin-Cruz, Perez-Santana, Hernangomez-Barahona, and Martin-Sierra (2010), α = .68; and Stevens and Campion's (1999) original scale development paper, α = .80 and .81 in two small samples (after deleting two items with negative item-total correlations that were later retained in the final published version [O'Neill et al., 2012]). Of these six studies, only two reported test-retest reliabilities (Chen et al., .60 and Martin-Perez et al., .72); both bordered on unacceptable in high-stakes testing contexts.

Overall, the reliability of the Teamwork KSA Test is moderate at best. Considering the high-stakes nature of personnel selection, work is needed to improve the internal consistency and stability of the measure. Further, subscale-level reliabilities are still unknown, with only Leach et al. (2005) reporting that they were extremely low (however, they did not specify coefficients).

Criterion Validity of the Teamwork KSA Test

Eight studies (representing nine samples) reported criterion validity coefficients for the Teamwork KSA Test. Roughly half of the studies were conducted using student samples; the other half used samples from manufacturing and production teams. It would be interesting to calculate average, sample-weighted, effect sizes, although, per meta-analytic guidelines like Oswald and Johnson (1998), the various studies' level of analysis and criteria varied too much to

do so meaningfully. The study correlations ranged from -.30 (Kottke, 2008) to .56 (Stevens & Campion, 1999). Average team-level prediction was .25 (*SD* = .17); average individual-level prediction was .17 (*SD* = .22). As noted by O'Neill et al. (2012), these findings are surprising given that the stated purpose of the Teamwork KSA Test is to predict individual-level outcomes. These data are consistent with earlier research by Allen and West (2005) that suggested mixed support for the criterion-related validity of the test.

O'Neill et al. (2012) also compared the criterion-related validity of the Teamwork KSA Test to both teamwork and taskwork criteria. Given that the stated purpose of the test was to predict teamwork, not taskwork, one would expect that predictor-criterion associations would be stronger in studies using teamwork criterion. Unfortunately, findings suggested the opposite—scores on the Teamwork KSA Test were more strongly associated with taskwork than with teamwork (Morgeson et al., 2005; Stevens & Campion, 1999).

The critical evaluation of the test-development process by O'Neill et al. (2012) illuminates possible explanations for the suboptimal psychometric properties of the test. Much of their process violates (or at least does not speak to) standard test-development practices as outlined in sources such as Hinkin (1995); Crocker & Algina, (1986); Nunnally (1994). Stevens and Campion (1999) began test construction by writing 46 situational items, each describing a teamwork scenario. Four multiple-choice response options were available for each item, with one response identified as the correct response. Correct responses were then coded 0 (*incorrect*) or 1 (*correct*). After developing the initial items, 234 undergraduate students answered the items. Stevens and Campion (1999) do not report whether the student respondents had any work-related teamwork experience. Based on item statistics, 35 of the initial 46 items were retained for the final Teamwork KSA Test.

Stevens and Campion (1999) do not make explicit whether items were written to measure the 14 specific constructs identified in their 1994 work. The taxonomy is mentioned as a guide, but it does not appear that the authors targeted a specific construct within their framework with each item. Instead, four judges assigned items to what they believed were the appropriate test subscales. Findings presented by Stevens and Campion (1999) suggest that the judges categorized the items relatively consistently but the final number of items in each of the five subscales varied: Conflict Resolution (4 items); Collaborative Problem Solving (8 items); Communication (12 items); Goal Setting and Performance Management (5 items); and Planning and Task Coordination (6 items). Subscale length differences are not inherently problematic, however it does raise reliability concerns (longer subscales will be more reliable) and concerns related to content validity (contamination and/or deficiency).

The process as described above deviates from standard test-development practices (Hinkin, 1995; Crocker & Algina, 1986; Nunnally, 1978) in several ways. First, tests should be developed to measure a specifically and clearly defined construct—however the overall test score from the Teamwork KSA Test does not appear linked to any defined construct in the Stevens and Campion (1994) taxonomy. This is particularly troubling because, as mentioned previously, the overall scale score has the highest reliability coefficients and is most recommended for use in practice. Second, scale construction research suggests that it is optimal to develop items deductively—i.e., with the theoretical construct informing and guiding the development of the items. Based on Stevens and Campion (1999), it appears that the items were written more inductively—the construct association of the items occurred at the end of the test construction process rather than the beginning. Third, factor analysis techniques should be used to confirm the extent to which the empirical structure of the test conforms to its theoretical

structure. However, per O'Neill et al. (2012), there are no published studies investigating the factor structure of the test. This absence casts a shadow on the score interpretations at the various levels of the test's scoring hierarchy. Fourth, despite mixed but general support for the criterion-related validity of the test, the sample sizes in these studies were small (N = 70 and N = 72), especially for long-term validation purposes.

In sum, the theoretical groundwork laid by Stevens and Campion (1994) in developing their taxonomy of teamwork KSAs is important and meaningful. However, significant problems exist with respect to the operationalization of the taxonomy. Reliability coefficients are marginal at best and mixed evidence exists with respect to the scale's validity. Further questions pertaining to the underlying factor structure of the theorized teamwork-related constructs remain unexplored and unanswered. The current research seeks to remedy these problems by developing a new measure of the teamwork constructs described in Stevens and Campion (1994) but with close adherence to measurement and scale development best practices.

Development of a reliable and valid test of teamwork KSAs has important implications for the teamwork literature. A more reliable and valid teamwork KSA test would offer organizations an alternative to the Stevens and Campion (1999) Teamwork KSA Test that, as described above, has been shown to have lower-than-desirable and inconsistent validity coefficients and is lacking evidence of good psychometric structure. Given the heavy reliance on teams in contemporary organizations, a solid tool is needed to assist organizations with personnel-selection decisions for teams.

Chapter 5 - Study 1: Item and Scale Development

Given the ubiquity of teams in today's organizations, an important goal of practitioner-oriented research should be to develop quality selection tools that can be utilized for selecting job candidates into team-based positions. As described previously, Stevens and Campion (1994) reviewed the team and group dynamics literatures and identified KSAs posited as important for effective teamwork. Stevens and Campion (1999) also created a paper-and-pencil multiple-choice selection test to measure the KSAs they defined in 1994. Despite initial optimism about the quality of the scale, critical evaluation by O'Neill et al. (2012) revealed significant problems with the scale's reliability, factor structure, and overall construct validity. The goal of the current research is to remedy some of these shortcomings by creating a valid and reliable test based on the teamwork KSAs identified by Stevens and Campion (1994). Study 1 defines the procedures and results associated with the scale-development process.

Methods

Item Generation

Following scale development best-practices as outlined in Crocker and Algina (1986) and Hinkin (1995), 50 Likert-style items were generated iteratively by researchers with expertise in team selection and scale development. A deductive approach to item generation was used—i.e., items were written to measure behavioral aspects of KSAs that have been identified by previous research (Stevens & Campion, 1994) to be important for successful teamwork. The interpersonal skills content domain was reflected in items such as, "*I have routinely considered perspectives other than my own when problem solving at work"* or "*Coworkers have often told me that I am open and accepting of other people at work."* The self-management content domain was reflected in items such as, "*When I have set goals for myself at work, I made sure they were*

challenging but realistic" or "*I have frequently given coworkers both positive and negative feedback about their performance."* Ten items per content domain were created to allow for item trimming during scale development. After constructing the initial items, five subject-matter experts with experience in scale development and familiarity with teamwork reviewed each item for accuracy, construct deficiency, and contamination. Additionally, after reading brief operational definitions of the five teamwork content domains, the experts were asked to allocate each item into its appropriate KSA category and to give feedback on the quality and clarity of the wording for each item. Items with similar wording and those that were unclear, vague, or could belong to any content category were trimmed. Items that achieved 80% or greater inter-rater agreement were retained for consideration for the final measure. After initial item-generation and trimming steps were completed, a total of 30 items measuring five teamwork-related constructs were retained (see Table 1).

Table 1

Initial Items of the Team KSA Test

Item #	**Item**	**Rev 1**	**Rev 2**	**Rev 3**	**Rev 4**	**Rev 5**	**Agree**
	Retained Items for Initial Scale (*N* = 30)						
COM1	I have often enjoyed "small-talk" when I am in a group at work	CM	CM	CM	CM	CM	5
GS1	When at work, I have typically set up specific goals to help me accomplish my objectives	GS	GS	GS	GS	GS	5
PM1	I have often given constructive feedback about work performance to my coworkers and/or teammates	PM	PM	PM	PM	PM	5
CR1	I have routinely used formal conflict resolution strategies to solve problems with coworkers	CR	CR	CR	CR	CR	5
GS6	To improve the performance of my teammates at work, I have routinely given them specific feedback about what they are doing well	GS	GS	GS	GS	GS	5

PS1	Typically when solving problems at work, I have preferred brainstorming with a group versus trying to solve the problems myself	CR	PS	PS	PS	PS	4
PM2	I have frequently given coworkers both positive and negative feedback about their performance	PM	PM	PM	PM	PM	5
COM2	Coworkers have often told me that I am open and accepting of other people at work	PS	CM	CM	CM	CM	4
PM3	When I have given feedback to teammates at work I have focused on work behaviors not personal characteristics	CM	PM	PM	PM	PM	4
COM3	My coworkers have often told me that they feel I respect their opinions	CM	CM	CM	CM	CM	5
COM4	When in discussions with coworkers, I have listened openly to their opinions	PS	CM	CM	CM	CM	4
COM5	I have routinely made efforts to understand the perspectives of my coworkers even if they are different from my own	PS	CM	CM	CM	CM	4
CR2	My teammates have often asked me to help resolve issues between coworkers	CR	CR	CR	CR	PS	4
PM4	When working as part of a team, I have frequently set up feedback loops to help teams monitor their work performance	PM	PM	PM	PM	PM	5
GS2	I have routinely set measureable goals for the work I want to accomplish	GS	GS	GS	GS	GS	5
CR3	Coworkers have often told me that I am good at finding “win win” solutions to conflicts at work	PS	CR	CR	CR	CR	4
CR4	When conflict between coworkers has occurred, I have known what to do to successfully resolve the situation	PS	CR	CR	CR	CR	4
PS2	I have routinely considered perspectives other than my own when problem solving at work	PS	PS	PS	PS	CM	4
PS3	During meetings at work, I have frequently asked for input from team members to solve problems	PS	PS	PS	PS	CM	4
COM6	Work colleagues have often told me that I am a great communicator	CM	CM	CM	CM	CM	5
PS4	I have often “drawn out” shy team members during group discussions at work so they contributed to the conversation	PS	PS	PS	PS	PS	5
CR5	I have been highly successful resolving conflicts with coworkers	CR	CR	CR	CR	CR	5

CR6	I have resolved a serious interpersonal conflict between myself and a coworker	CR	CR	CR	CR	CR	5
PS5	While at work, I have frequently engaged teams of people in discussion to solve specific problems	PS	PS	PS	PS	PS	5
GS3	When I set goals for myself at work, I made sure they were challenging but realistic	GS	GS	GS	GS	GS	5
GS4	When I have set up work goals for my team, I made sure the goals were realistic and attainable	GS	GS	GS	GS	GS	5
PM5	When setting up a new project at work, I have emphasized clearly defining tasks so the team knows exactly what needs to be done	PM	PM	GS	PM	PM	4
PM6	When beginning a new project at work, I have always made sure the roles and responsibilities of teammates are clear and understood	PM	PM	PM	PM	PM	5
GS5	When I have set up work goals for my team, I set specific timeframes for completion	GS	GS	GS	PM	GS	4
PS6	During group discussion at work, I have consistently made efforts to ensure that everyone in the group has an opportunity to share their perspective	PS	PS	PS	PS	CM	4
	Items not Retained for Initial Scale (N = 20)						
6	I have effectively helped resolve conflicts between teammates	CR	CR	CR	CR	CR	5
4	I have been highly successful at resolving problems between team members at work	CR	CR	PS	PS	PS	3
5	When discussing work problems as part of a team, I have frequently prevented one team member from dominating the discussion	CR	PS	PS	PS	CM	3
18	I can think of many examples where I have disagreed with my coworker, but have done so constructively and respectfully	CR	CR	PS	CM	CM	2
21	While at work, I have understood the difference between problems that are best solved as a team and problems that I should solve by myself	PS	PS	PS	PS	PS	5
28	I can explain the difference between healthy and unhealthy conflict	CR	CR	CR	CR	PS	5
34	I am often successful planning and coordinating work tasks for teams	PS	GS	PM	PM	PM	3

38	It is common for me to fix situations at work where teammates are out of sync	CR	CR	CR	PS	PS	3
40	I have formal training in collaborative problem solving techniques and frequently apply them at work	PS	PS	PS	PS	PS	5
45	I have fixed "goal conflict" problems with many teams at work	CR	CR	PS	GS	GS	2
47	I have led group discussions at work about the pros and cons of formal Goal Setting Theory as articulated by Gary Latham and Edward Locke	GS	GS	GS	GS	GS	5
50	I can think of specific examples where I have successfully resolved a minor conflict between myself and coworkers	CR	CR	CR	PS	CR	4
29	I have often applied the "Delphi technique" to group problem solving at work	PS	PS	PS	PS	--	4
44	Coworkers have often told me that I am good at collaborating with others	PS	PS	PS	PS	PS	5
25	I have routinely used active listening skills in my conversations with others at work	CM	CM	CM	CM	CM	5
16	I have often used performance management theory at work	PM	PM	PM	PM	PM	5
8	I can think of many examples at work where I effectively linked individual performance to team performance	PM	PM	PM	PM	PM	5
31	I have set up many successful performance management systems for work teams	PM	PM	PM	PM	PM	5
27	To improve the performance of my teammates at work, I have routinely given them specific feedback about what they are not doing well	PM	PM	PM	PM	GS	4
10	I have consistently and accurately identified different sources of team conflict at work	CR	PS	CR	CR	CR	4

Participants

An online (Amazon Mechanical Turk) sample of 600 individuals answered the initial set of scale items during the week October 14, 2019. The obtained sample was large enough to accommodate scale development best-practice recommendations (Hinkin, 1995; Tabachnick &

Fidell, 2007) of a 10 to 1 ratio of respondents to scale items for both the primary and hold-out samples. This is especially important when the methodological plan includes multivariate techniques such as factor analysis because concerns have been raised about sample-specific results from factor analysis, especially when sample sizes are smaller (Schwab, 1980). A large sample is also necessary so that CFA results can be validated against an adequately sized hold-out sample. Some scholars (e.g., Couper, 2000) have raised concerns about the use of online samples, arguing that they risk introducing selection bias into the sample. Highhouse and Gillespie (2009), however, cite findings from five meta-analyses suggesting that specific nature of the sample does not impact the generalizability of study results. These findings, coupled with the convenience of online data collection and the likelihood that online samples are more demographically diverse than typical student samples (such as those used in the initial scale development by Stevens and Campion, 1999), justify the use of an online sample for the current research.

Respondents were male (51%), Caucasian (70%), between the ages of 30 and 49 (57.9%), employed working 40 hours or more per week (83%), who had been working in their current position for two to five years (34%) or for longer than five years (48%). A hold-out sample of 179 participants was created by randomly sampling participants from the main data set. There were no significant demographic differences between samples. The hold-out sample was used to cross-validate the final CFA models described below.

After answering standard demographic questions, survey respondents were informed that they would answer questions about ways they approach their work. Respondents were given the following prompt: “The following questions ask about how you typically do your job. Please indicate your level of agreement/disagreement with each of these statements using the scale

below." Participants were asked to rate their responses on a Likert scale with anchors ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). No neutral scale anchor (e.g., *neither agree nor disagree*) was provided to avoid the risk of confounding item-meaning uncertainty with an authentic midrange rating of the attribute (Clark & Watson, 1995). Administration of the online survey represented data-collection procedures approved by the Kansas State University Institutional Review Board and survey respondents indicated informed consent before participating. The presentation order of the items was randomized to avoid potential item-order effects.

Results

Data-screening procedures following Tabachnick and Fidell (2007) were conducted using SPSS programs. One record with missing data was deleted from the sample. Scale completion time data were also evaluated. Respondents with survey completion times of less than three minutes were deleted from the sample. The practice of eliminating surveys with completion times that are less than one-third of the median completion time aligns with large, research-based survey administration organizations (e.g., Qualtrics). After these preliminary screening procedures were performed, a total sample of 479 remained. Linearity, normality, and homoscedasticity assumptions were checked and confirmed using a normal probability plot of standardized residuals (to test linearity), a regression of standardized residuals onto a dummy dependent variable (to test homoscedasticity), and a visual check of the normal curve superimposed over histograms for each item to "test" normality. Multicolinearity was evaluated using a conservative variance inflation factor (VIF) threshold of three (larger VIF values indicate higher standard error). Using an iterative process, independent variables (IV) were regressed onto an isolated IV which was used as a dependent variable (DV). All VIF values were below

three, indicating no issues with multicolinearity in the data set. To check for univariate outliers, item scores were converted to *z* scores. Outliers were those cases that exceeded the *z* +/- 3.29 criterion. There were 19 cases identified as outliers. All of the Likert scale anchors were considered plausible response options, so these cases were retained. Multivariate outliers were checked using Mahalonobis Distance (MD), which were computed by regressing all scale items against a dummy dependent variable (ID#). MD values were then compared against a chi square distribution table. Values that fell below a $p < .001$ were identified as outliers. Twelve multivariate outliers were identified and deleted from the data set. Thus, 467 cases were retained for model development and confirmatory factor analysis (CFA).

An item analysis of the initial 30 scale items was conducted. Per recommendations of Clark and Watson (1995), two items with minimal response variance (> 95% of respondents chose the same anchor) were eliminated. An internal consistency reliability analysis of the remaining 28 items was also conducted. The goal was to identify and eliminate items that were negatively impacting overall scale reliability. Coefficient alpha (an indicator of scale internal consistency reliability) was high ($\alpha = .95$), indicating good internal consistency, but also potentially suggesting redundancy of item content. Using the SPSS "alpha if removed" function, items were trimmed with the goal of reducing scale length without compromising internal consistency estimates or subscale content. A final set of 15 items was retained (see Table 2 for a list of final items and descriptive statistics). Internal consistency estimates were strong for both the overall 15-item scale ($\alpha = .92$) and for individual subscales (8-item interpersonal skills subscale $\alpha = .87$; 7-item self-management skills subscale $\alpha = .88$).

Table 2. Initial Items and Descriptive Statistics for the 15-TKT

	Sample 1 (*N* = 300)				Sample 2 (*N* = 167)			
	M	SD	Skew	K	M	SD	Skew	K
COM2. Coworkers have often told me that I am open and accepting of other people at work	4.72	1.0	-1.0	1.7	4.6	1.1	-.67	.26
COM3. My coworkers have often told me that they feel I respect their opinions	4.66	1.1	-.90	.76	4.7	1.0	-.88	1.0
PS3. During meetings at work I have frequently asked for input from team members to solve problems at work	4.6	1.2	-1.0	.82	4.5	1.1	-.97	1.2
PS5. While at work, I have frequently engaged teams of people in discussion to solve specific problems	4.5	1.1	-.92	.96	4.5	1.1	-.76	.77
PS6. During group discussions at work, I have consistently made efforts to ensure that everyone in the group has an opportunity to share their perspective	4.92	.93	-1.4	3.2	4.8	.98	-1.1	1.5
CR2. My teammates have often asked me to help resolve issues between coworkers	3.91	1.4	-.42	-.51	4.0	1.3	-.50	-.50
CR4. When conflict between coworkers has occurred, I have known what to do to successfully resolve the situation	4.5	1.0	-.72	.97	4.2	1.1	-.64	.43
CR5. I have been highly successful resolving conflicts with coworkers	4.43	1.0	-.60	.62	4.3	1.1	-.76	.45
PM1. I have often given constructive feedback about work performance to my coworkers and/or teammates	4.7	1.0	-1.1	1.7	4.6	1.0	-.67	.48
PM5. When setting up a new project at work, I have emphasized clearly defining tasks so the team knows exactly what needs to be done	4.8	.92	-1.1	2.0	4.8	1.0	-1.1	1.7
PM6. When beginning a new project at work, I have always made sure the roles and responsibilities of teammates are clear and understood	5.0	.86	-1.1	2.2	4.9	.98	-1.2	2.4
GS3. When I have set goals for myself at work, I made sure they were challenging but realistic	4.9	.92	-1.3	3.2	4.8	.82	-.55	.31
GS4. When I set up work goals for my team, I made sure the goals were challenging but still attainable	4.8	.95	-1.4	3.3	4.7	.95	-.94	1.5
GS5. When I have set up work goals for my team, I set specific timeframes for completion	4.7	1.0	-1.2	2.4	4.7	1.0	-1.2	2.4
GS6. To improve the performance of my teammates at work, I have routinely given them specific feedback about what they are doing well	4.6	1.2	-1.1	1.2	4.6	1.0	-.81	.84

CFAs were conducted using structural equation modeling computer software (Amos 18, Arbuckle, 2009) using maximum likelihood estimation (MLE). MLE is the most commonly used technique and was appropriate for the current research given that the data were normally distributed. A primary objective in scale-development research using CFA is to assess the "fit" of the proposed models to the data. Specifically, the fidelity of the sample data covariance matrix to the estimated population covariance matrix is assessed using a nonsignificant χ^2 as the criterion. However, with large sample sizes (such as with the current research), trivial differences between the sample and estimated covariance matrices are often significant because the calculation of χ^2 involves multiplying the minimum of the function by $N - 1$ (in the current research $N - 1 = 466$). Thus, researchers have proposed a variety of other descriptive model fit indices; which indices to use is a matter of personal preference on the part of the researcher (Tabachnick & Fidell, 2007).

For the current research, the following test statistic and indices were used to assess goodness of fit: χ^2, χ^2/df comparative fit index (CFI), goodness-of-fit index (GFI), root mean squared error of approximation (RMSEA), and the standardized root mean square residual (SRMR). The CFI is important because it is a relative index—i.e., it compares the estimated population covariance matrix against both an independent model (comprised of unrelated variables) and a saturated (perfect-fitting) model. The resulting fit index lies in the 0 to 1 range, with values approaching 1 considered optimal. Hu and Bentler (1999), recommend a CFI value of .95 (or higher) as indicative of a good-fitting model. RMSEA is also important because it provides a slightly different fit assessment. RMSEA estimates the lack of model fit compared to a saturated (perfect) model. When model fit is saturated, the RMSEA yields a value of 0; as model misspecification increases, the RMSEA value increases indicating a poor-fitting model.

Hu and Bentler (1999) recommend a RMSEA value of .06 (or less) as indicative of a good-fitting model. SRMR is also commonly used in assessing model fit because it uses the residual values from the comparison of the sample and estimated population covariance matrices. Good-fitting models will have small residual values because the sample covariance matrix and the estimated population covariance matrix approximate one another. The SRMR values range from 0 to 1, with values of .08 or less indicating good model fit (Hu & Bentler, 1999). The final fit index used in the current research (GFI) is analogous to R^2 in regression in that it calculates the proportion of variance in the sample covariance matrix that is explained by the estimated population covariance matrix (Tabachnick & Fidell, 2007). Values range from 0 to 1 with values of .95 or higher indicating greater variance explained, and thus a better-fitting model. In sum, the current research uses a variety of model fit indices as criteria for testing model fit: χ^2, χ^2/df F < = 2 (Tabachnick & Fidell, 2007); for CFI, GFI, RMSEA, and SRMR, the current research follows the cut-off recommendations of Hu and Bentler (1999).

Previous research (Stevens & Campion, 1999) left questions unanswered about the underlying factor structure of the teamwork KSAs. Thus, a central purpose of the current research was to test measurement models associated with teamwork KSAs. The CFA technique essentially combines EFA and regression techniques to simultaneously test measurement models and structural models. The measurement model tests whether the theorized latent constructs predict variance in the observed variables that have been chosen to represent the latent constructs. The structural model tests predicted associations between constructs. The underlying theoretical implication of CFA is that underlying latent constructs (in this case, communication, conflict resolution, collaborative problem solving, goal setting, and performance management) cause respondent agreement or disagreement with the various items. Achieving a good-fitting

model suggests that the items created are adequate indicators of the (or at least of some) constructs.

As described above, Stevens and Campion (1994) theorize that teamwork is comprised of two fundamental constructs: interpersonal skills and self-management. Interpersonal skills include communication, conflict resolution, and collaborative problem solving. Self-management includes goal setting and performance management. Thus, five separate CFAs were tested to evaluate the measurement model associated with the aspects of teamwork. One model comparison tested whether a one-factor or three-factor model best fit the theorized interpersonal skills construct. Another model comparison tested whether a one-factor or two-factor model best fit the theorized self-management construct. A final model tested the fit of an overall five-factor teamwork model comprised of communication, conflict resolution, collaborative problem solving, goal setting, and performance management.

The final retained scale items were divided into their theoretically derived categories to test the described models. Eight items represented interpersonal skills; seven items represented self-management skills. The first model comparisons (one-factor vs. three-factor interpersonal skills) were tested on the main sample (N = 300). The three-factor model included first-order latent factors (communication, conflict resolution, problem solving) indicated by the measured items for each. The one-factor model included a single higher-order factor (interpersonal skills) indicated by the same measured items used in the three-factor model test. All factors in both models were tested simultaneously. Both eight-item models fit the data well, however the three-factor model demonstrated excellent fit. Factor loadings of items (three-factor model) were strong, ranging from .69 to .82 (above the .50 cutoff recommended by Comrey & Lee, 1992). The three-factor model was also congeneric, meaning the items were allowed to load on only one

of the three first-order factors and residuals were not allowed to covary. Acceptable model fit for the single-factor solution was obtained only after allowing some of the residuals to covary based on AMOS-generated modification indices (an acceptable practice given wording similarities of some of the items). The three-factor model of interpersonal skills best fit the data; fit statistics were well within the cut-off ranges recommended by Hu and Bentler (1999): [$\chi 2(17) = 38.00$, $p = .003$; $\chi 2/DF = 2.22$; RMSEA = .06; SRMR = .04; CFI = .98; GFI = .97]. This model appears in Figure 2. Fit statistics for both models are shown in Table 3.

Figure 2. Standardized parameter estimates for first-order CFA, Interpersonal Skills. (Text in boxes corresponds to items in Table 2.)

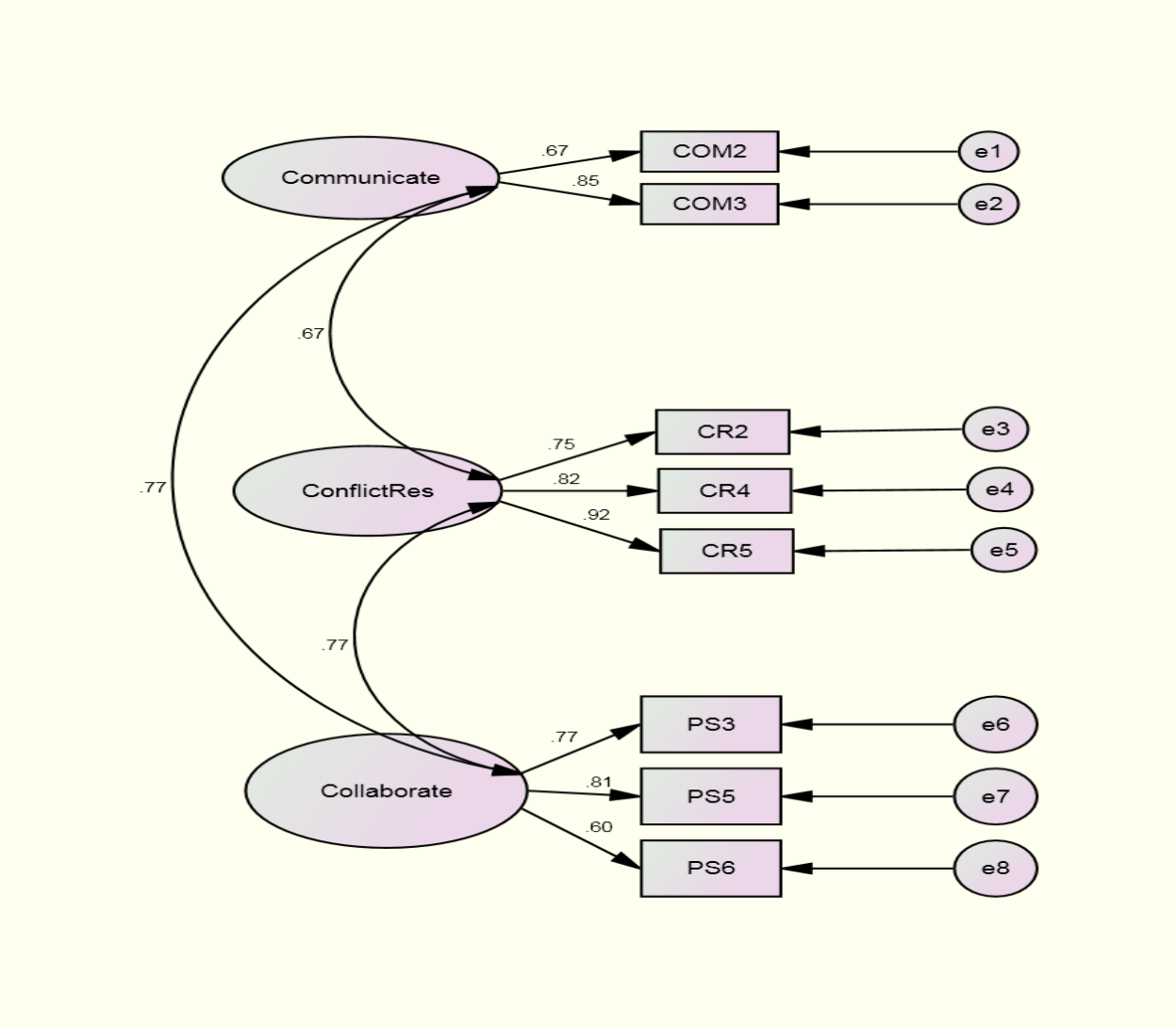


Table 3

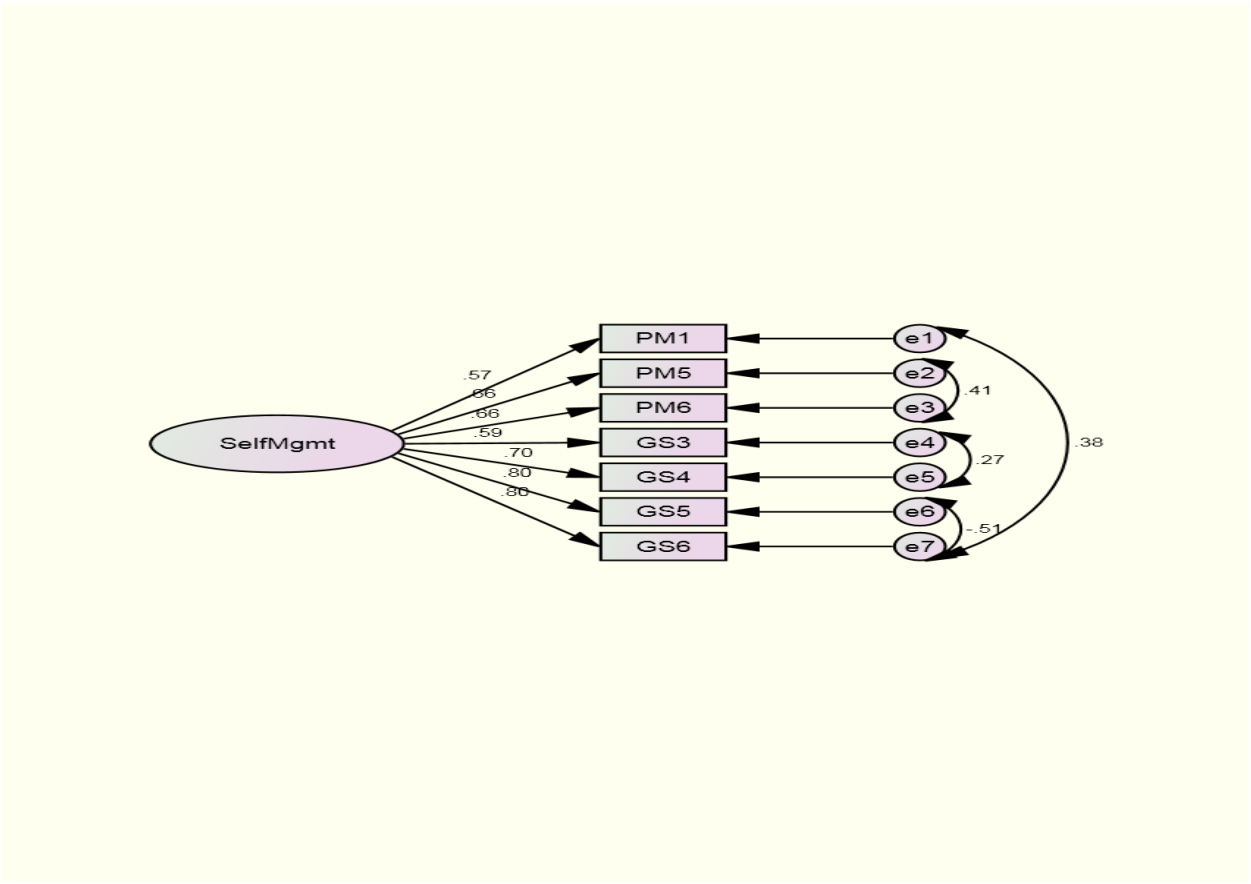
Chi Square and Model Fit Indices

	Sample 1 (N = 300)					
	X^2	$X^{2/DF}$	RMSEA	SRMR	CFI	GFI
Interpersonal Skills						
Three-factor	38	2.2	.06	.04	.98	.97
One-factor	64	3.4	.09	.04	.95	.95

Self-Mgmt Skills						
One-factor	10	1.5	.04	.02	.99	.98
Two-factor	133	10.27	.18	.07	.87	.90
Overall Team Skills	219	2.7	.08	.05	.94	.91

The next model comparisons (one-factor versus two-factor models of self-management skills) were tested on the main sample (N = 300). The two-factor model included first-order latent factors (goal setting and performance management) indicated by the measured items for each. The one-factor model included a single higher-order factor (self-management) indicated by the same measured items used in the two-factor model test. All factors in both models were tested simultaneously. Both seven-item models fit the data well, however the single-factor model demonstrated excellent fit. Factor loadings (single-factor model) were strong, ranging from .57 to .80 (above the .50 cutoff recommended by Comrey and Lee, 1992). Model fit estimates for the single-factor solution were obtained after allowing several of the residuals to covary based on AMOS generated modification indices. This is an acceptable practice given the similar wording of the items and that all error terms related to a single latent factor (Ullman, 2006). The single-factor model of self-management skills best fit the data; fit statistics were well within the cut-off ranges recommended by Hu and Bentler (1999): [$\chi 2(10) = 15.00$, $p = .123$; $\chi 2/DF = 1.5$; RMSEA = .04; SRMR = .02; CFI = .99; GFI = .98]. This model appears in Figure 3. Fit statistics for both models are shown in Table 3.

Figure 3. Standardized parameter estimates for a first-order CFA, Self-Management Skills. (Text in boxes corresponds to items in Table 2.)



A final analysis was conducted assessing fit for a first-order five-factor teamwork model. The five-factor model included first-order latent factors (goal setting and performance management, communication, collaborative problem solving, and conflict resolution) indicated by the measured items for each. As with the other models tested above, item-factor loadings were strong and well above recommended minimums. Model fit indices for the five-factor solution suggested marginal model fit; many of the indices were not within the cut-off ranges recommended by Hu and Bentler (1999): [$\chi 2(80) = 219.00$, $p = .000$; $\chi 2/DF = 2.7$; RMSEA = .08; SMRM = .05; CFI = .94; GFI = .91] therefore, this model is not presented.

Overall, several conclusions can be drawn based on these data. Initial measurement models for teamwork KSAs have been adequately represented by the items from the 15-TKT. A

model including three, highly correlated, latent constructs (communication, conflict resolution, problems solving) representing interpersonal skills fit the data best. A model including one latent construct (self-management) representing self-management skills fit the data best. These data constitute evidence that the constructs of interpersonal skills and self-management skills exist and that (at least some) of the measured variables are significant indicators of the constructs (Ullman, 2006).

These data justify aggregating 15-TKT scores from the measured items into two subscale scores: one score for interpersonal skills and one for self-management skills. The three-factor model of interpersonal skills demonstrated the best fit to the data and the correlations between the latent constructs were high (r = .67 to .77). The single-factor model demonstrated the best fit to the data for self-management skills so correlations between latent constructs are not relevant. However, it is noteworthy that the two-factor model of self-management skills also fit the data well and that correlations between latent constructs were also high (r = .89). Correlations between latent variables in the five-factor model (overall teamwork) were less strong, especially between interpersonal skill and self-management skill content domains.

Cross-Validation

CFAs were also conducted on all models described above (except the single-factor teamwork model) using data drawn from an independent hold-out sample (N = 167) to test the replicability of the models derived from the preliminary analyses. The MLE method was again used. The fit indices suggest that the correspondence between proposed models and the data was excellent. The test statistic and fit indices for the three-factor model of interpersonal skills were similar to those generated based on the first sample: [$\chi 2(17) = 38.00$, p=.002; $\chi 2/DF = 2.2$; RMSEA = .08; SMRM = .04; CFI = .97; GFI = .95]. The test statistic and fit indices for the

single-factor model of interpersonal skills were also similar to those generated based on the first sample: [$\chi 2(10) = 15.00$, $p = .121$; $\chi 2/DF = 1.5$; RMSEA = .05; SMRM = .02; CFI = .99; GFI = .98]. A summary of all model fit statistics and indices are presented in Table 4. Given the similarity of the model fit between the first and second samples, confidence in the fidelity of the proposed models is reasonable.

Table 4. *Model Fit Comparisons: Primary to Cross-Validation Samples*

	Sample 1 (*N* = 300)						Sample 2 (*N* = 167)					
	X^2	$X^{2/DF}$	RMSEA	SRMR	CFI	GFI	X^2	$X^{2/DF}$	RMSEA	SRMR	CFI	GFI
Interpersonal Skills												
Three factor	38	2.2	.06	.04	.98	.97	38	2.2	.08	0.05	.97	.95
Self-Management Skills												
One factor	15	1.5	.04	.02	.99	.98	15	1.5	.06	.04	.98	.97

Study 1 Discussion

Given the importance of teams to organizations, human resource practitioners within organizations need tools to help them select job applicants for work in teams, but to date, team researchers have done relatively little work in this area. The overall goal of Study 1 was to meet this need by developing a reliable measure of the teamwork KSAs proposed by Stevens and Campion (1994). A second goal was to provide preliminary evidence about the factor structure of the teamwork content domain. Achieving this objective would represent substantial improvements over prior efforts (Stevens & Campion, 1999) to measure this content area.

Overall results from Study 1 suggest that these goals have been accomplished. The new 15-TKT demonstrated high levels of internal consistency both for the overall 15-item scale (α = .92) and for the interpersonal skills (α = .87) and self-management skills (α = .87) subscales. Additionally, the models depicting the underlying factor structure of the content domains showed excellent fit to the data. Thus, as discussed earlier, the data suggest that models for teamwork KSAs have been adequately represented by the items from the 15-TKT and that the constructs of interpersonal and self-management skills exist and are significantly indicated by the measured variables.

These findings contribute to the teamwork literature in several ways. First, the teamwork KSA content domain can be measured reliably. A criticism of previous work in this area by Stevens and Campion (1999) is that internal consistency reliability coefficients for the overall scale were inconsistent, low, and unknown for the subscales (O'Neill et al., 2012). The current research represents evidence that the content domain, including subscales, can be measured reliably.

Second, the factor structure and related measurement model for the teamwork KSA content domain, has heretofore been unexplored. The current research provides empirical support that the interpersonal and self-management KSA content areas can be adequately represented by a three-factor model and a one-factor model, respectively.

Despite these promising results, a note of caution is warranted. As pointed out by Ullman (2006), "Although we are interested in the theoretical constructs of [in this case] interpersonal and self-management skills, [with CFA] we are essentially defining the constructs by the indicators we have chosen to use. Other researchers also interested in interpersonal and self-management skills could define these constructs with completely different indicators and thus

define somewhat different constructs" (p. 37). A common shortcoming in SEM/CFA is to forget that good-fitting models, especially in early stages of scale development, indicate only that the measured items are effectively tapping into *some* underlying construct(s), not necessarily *the* construct of interest. Additional research is needed to solidify the overall factor structure and construct validity of the 15-TKT.

A second point of caution is also warranted and relates to potential content deficiency of the 15-TKT. As described previously, care was taken during item writing to adequately represent the entire theoretical range of teamwork KSAs as described by Stevens and Campion (1994). Thus, items were written to measure obvious content—for example, whether one sets specific measureable goals for themselves and for their teams. But items were also written to measure more nuanced content, such as the use of active listening skills. The irony is that despite this care and attention to detail, some of the items written to measure the more nuanced KSAs were dropped during initial item review because reviewers did not agree on the theoretical category of the item. Additionally, some of the items written to measure subtle content were judged by item reviewers as being vague or unclear. If time were not a factor in the current research, several more iterations of item writing and editing would have likely benefitted the end product. Future research should anticipate these challenges and use an iterative item development process to ensure that concerns related to both SME agreement and content validity are addressed.

Chapter 6 - Study 2: 15-TKT Validation Study

Although Study 1 provided preliminary evidence supporting the reliability and psychometric structure of the 15-TKT, two central questions remain. The first is the extent to which teamwork behaviors, as measured by the 15-TKT, relate to actual teamwork performance. Individual differences in team skills (as measured by the 15-TKT) should reflect differences among individuals with respect to their actual performance as a team member. An interesting and important finding from the Stevens and Campion (1999) validation study of the Teamwork KSA Test was that scores on the test showed higher correlations with measures of taskwork than teamwork. Given that the central purpose of the Teamwork KSA Test was to measure teamwork (and not taskwork), this finding is as meaningful as it is surprising and is indicative of the unresolved validity challenges facing the Teamwork KSA Test. Thus, in the current research, an important question relates to the association of scores on the 15-TKT to a measure of teamwork performance. Given that items from the 15-TKT ask about communication, conflict resolution, and problem-solving behaviors—all behaviors that are logically and empirically (Stevens & Campion, 1994) associated with teamwork—it is reasonable to expect that individuals who score high on the two dimensions of the 15-TKT would also receive high teamwork performance ratings from their immediate supervisor.

Based on this rationale, the Hypothesis 1 is proposed: *Interpersonal and self-management skills scores from the 15-TKT predict significant variance in supervisor rating scores of teamwork performance.*

A second central question exists pertaining to whether teamwork performance (as measured by the 15-TKT) is moderated by team type. A central proposition from Stevens and Campion (1994) is that the KSAs they identified are generic, meaning they are important for

effective teamwork regardless of the kind of team or kind of work being performed. It is possible that effective team behaviors differ based on the kind of team and the kind of work the team is performing. For example, effective teamwork behaviors for a corporate executive team may differ from teamwork behaviors deemed effective for a road construction crew performing manual labor. However, it is also possible and reasonable that generic teamwork KSAs do exist. It is difficult to imagine, for example, that someone lacking basic communication skills or who avoids all forms of conflict would perform effectively as part of a team. This important validity-related question remains unanswered (O'Neill et al., 2012).

Based on this rationale, Hypothesis 2 is offered: *The significant relation between 15-TKT scores and supervisor ratings of team performance will not be moderated by team type.*

Thus, the purpose of Study 2 is to provide an initial exploration of the criterion-related validity of scores from the 15-TKT and to explore whether the relation of 15-TKT scores to supervisor ratings of team performance differs based on the kind of team in which the employee is working.

Method

Participants and Procedure

Participants in this study were 26 current employees of a large West Coast government organization. Participants were male (50%), Caucasian or Black (77%), between the ages of 30 and 49 (55%), employed working 40 hours or more per week (99%), who had been working in their current position for 1 to 5 years (95%). A convenience sampling technique was used to recruit employees for participation that were working in one of five team types as described in Sundstrom et al. (2000). Sundstrom and colleagues present a simple team taxonomy consisting of five basic team types: production teams, service teams, management teams, project teams, and

action and performing teams. Production teams are characterized by core employees who consistently and over time produce tangible products (e.g., road construction crews). Service teams participate in repeated transactions with customers (e.g., customer service representatives) whose needs vary, making the nature of the transactions variable. Management teams are characterized by senior managers responsible for directing and coordinating lower-level units (e.g., executive staff over different divisions of a human resources department). Project teams are time-bound teams that execute on specific tasks and then disband (e.g., software developers working on a new product). Action and performance teams are characterized by interdependent groups of experts who participate in complex performance tasks (e.g., military units). Given the author's firsthand knowledge of the type of work performed within his organization, employees were targeted for recruitment based on the kind of team in which they worked (see Table 5).

Table 5. *Team-Type Descriptions and Sample Sizes*

Sundstrom et al. (2000) Team Type	**Functional Team Type**	**Type of Work Performed**	**N**
Production Team	Road Construction Crew	• Road repair and maintenance	6
Service Team	Call Center	• Provide service to external customers via email or phone	5
Management Team	Executive Management Team	• Manage operations of divisions within west coast government organization	0
Project Team	IT/Exam Development Project Team	• Various IT related development projects • Selection exam development	11

The 15-TKT teamwork scale was administered via online survey to the 22 employees described above. Response rate was 79% (at the time of this writing no responses had been received from the executive management team).

Approximately concurrent with the administration of the 15-TKT, overall team member performance was rated by the team member's direct supervisor. The team performance rating consisted of a single-item measure of overall team performance. Prior to rating each team member, supervisors read instruction in which team performance was operationally defined. The instructions read:

> Below you will be asked to rate the overall performance of your team members related to their skills and abilities as team players. For the purpose of this study, "team player" means their skills and abilities to: 1) resolve conflict between themselves and fellow team members in a healthy and constructive way; 2) use collaborative approaches to problem solving (versus just solving problems on their own; 3) communicate openly and effectively verbally and in writing; 4) set goals for themselves so they are more efficient and productive; and 5) provide feedback to teammates, both positive and negative, to help improve performance. Please rate the overall performance of each of your employees as related to the criteria above. How would you rate the quality of this employee's performance as a "team player"?

Ratings were made for each employee by their supervisors (N = 4) using a 10-point Likert-type scale with anchors ranging from 1 (*extremely low*) to 10 (*extremely high*).

Results

Overall 15-TKT scale internal consistency estimates were slightly better than the reliability estimates from Study 1 ($\alpha = 93$), indicating consistent reliability of the new scale.

After checking standard regression assumptions (linearity, multicolinearity, homoscedasticity, and outliers) the initial analysis was conducted. To test Hypothesis 1—that supervisor ratings of teamwork performance are significantly predicted by the interpersonal skill and self-management skills scores of the 15-TKT—composite scores/variables were created for both self-management and interpersonal subscales of the 15-TKT by adding the subscale scores and dividing by the total number of items in the subscale. Multiple regression analysis was used to test if scores from the 15-TKT subscales (interpersonal skills and self-management skills) predicted participants' overall teamwork scores. The overall team performance score was regressed onto the two subscales of the 15-TKT (Interpersonal Skills and Self-Management Skills). The results of the regression indicated that two independent variables predicted a nonsignificant portion of the variance in the dependent variable ($R^2 = .08$, $F(2,19) = .473$, $p =$ n.s.). Results of the analysis are presented in Table 6. These results indicate that scores from the 15-TKT are not related to teamwork performance (operationalized as supervisor rating of team performance rating; $R = .28$, $p < .47$). Thus, Hypothesis 1 was not supported.

Table 6. *Multiple Regression Results Predicting Team Performance from Interpersonal and Self-Management Skill Subscales of 15-TKT*

Predictor	R^2	ΔR^2	*B*	*SE*	β

Model 1	.08	.08			
Interpersonal Skills			-.06	.07	-.39
Self-Management Skills			.04	.10	.15

Given the nonsignificant results of the initial regression analysis, the moderator analyses from Hypothesis 2 were not conducted.

Study 2 Discussion

Given promising results from Study 1 supporting the reliability and psychometric structure of the 15-TKT, Study 2 was conducted to test two preliminary but central questions related to the validity of new scale. The first is the extent to which teamwork behaviors, as measured by the 15-TKT, relate to actual teamwork performance. As argued above, individual differences in team skills (as measured by the 15-TKT) should reflect differences among individuals with respect to their actual performance as a team member. This concern is especially salient given findings from Stevens and Campion (1999) that scores from their Teamwork KSA Test showed higher correlations with measures of taskwork than teamwork. Ostensibly, practitioners that choose tools like the 15-TKT want/need a scale that predicts teamwork ability over and above taskwork performance. Establishing that the 15-TKT is strongly associated with teamwork behaviors would represent an important step in this direction.

The second question that Study 2 was designed to test was whether the association between scores on the 15-TKT and ratings of individual teamwork performance were moderated by team type. As previously discussed, the teamwork-related KSAs identified by Stevens and Campion (1994) were posited to be generic—i.e., they were transportable and important for effective teamwork regardless of the type of team in which the work was being performed.

Unfortunately, results from Study 2 did not support either hypothesis. Scores from the 15-TKT did not predict a significant amount of variance in the teamwork performance rating, and therefore the moderator analysis was not conducted. Several observations about Study 2 are warranted that may provide insight into these results.

First, a single-item measure of overall team performance was used as the dependent variable in the study. Debate exists about the efficacy of using of single-item measures of performance (Wanous, Reichers, & Hudy, 1997), so it is possible that a multi-item measure of team performance would have generated more variance and therefore better results. Anecdotal evidence supports this possibility (one of the supervisor participants in the current research rated *all* team member performance identically).

This fact raises a second possibility that could be negatively impacting population estimates of correlations between 15-TKT scores and overall team member performance, namely range restrictions in the dependent variable. As described above, overall team performance was measured using a single item of team performance using a 10-point scale. The goal of using a 10-point scale was to maximize variance in the dependent variable to increase the likelihood of finding significant study effects. Descriptive analysis of the dependent variable showed only a 5-point range on the DV (minimum of 4, maximum of 8), thus the 10-point item was effectively reduced to 5. As noted by Howell (2007), range restrictions in either the dependent or independent variables most often have the effect of reducing the estimated correlation between variables, so it is possible, even likely, that a DV with more variance would have enhanced the likelihood of a significant finding.

A third consideration limiting findings from Study 2 is the extremely small sample size (N = 22). A power analysis indicated that to obtain power .80 for the current study, a sample size

of at least 130 participants would be needed to detect bivariate correlations of .25 or bigger. It is possible that real effects between the 15-TKT and teamwork performance exist but are smaller than .25, thus an even bigger sample would be needed to produce statistically significant results. Attempts to recruit a larger sample in the current study fell short. Many of the potential study participants worked in unionized settings and wanted to obtain permission from union officials before participating in any research. Time limitations made waiting for union approval unrealistic. As such, it is likely that the study lacked sufficient power to identify even moderate effect sizes.

In addition to small sample size, problems with range restriction in the DV, and use of a single-item measure of team performance, a fourth consideration impacting the results of Study 2 is sample bias. For efficiency, a convenience sample was recruited for study participation based on teams that were known to the study author. The goal of inferential statistics is to generalize study findings to an entire population of interest (i.e., to establish external validity), in this case work teams in organizations. The sampling techniques used in Study 2 make any such inferences untenable.

A fifth potential problem associated with the Study 2 is that teamwork performance ratings were obtained by a single team supervisor. Given what is known about the challenges associated with performance ratings in general (e.g., DeNisi & Murphy, 2017), a more robust study design would have been to collect ratings from multiple supervisors and to include peer rating of teamwork performance. This approach would have likely yielded a better picture of team members' team performance.

In sum, Study 2 suffered from considerable shortcomings that likely hindered finding a significant effect between the study variables. Future research should use the 15-TKT in a more

robust study with larger sample sizes and better measures of team performance to test the hypotheses from Study 2.

Chapter 7 - Discussion

The ability of an employee to perform well as part of a team or group has emerged as an important individual difference variable in teams research. Despite a large and exhaustive personnel selection literature investigating factors associated with individual work performance, very little work has been conducted exploring factors associated with teamwork. As discussed in considerable detail above, Stevens and Campion (1994) conducted an exhaustive review of the groups/teams literature and deduced 14 KSAs posited as important for performing well in a team. Based on this work, Stevens and Campion (1999) produced a paper-and-pencil, multiple-choice examination to measure the KSAs identified in their earlier work. Unfortunately, critical evaluations of the test (O'Neill et al., 2012) suggested serious deficits with respect to the scale's overall psychometric properties, including internal consistency and factor structure. The objective of the current research, therefore, was threefold:

1. Develop a more psychometrically sound measure of the teamwork KSAs identified in Stevens and Campion's earlier (1994) work.
2. Collect and present predictive validity evidence for the new scale.
3. Examine whether teamwork performance and 15-TKT scores is moderated by team-type.

As described, the scale development study was conducted in accord with scale development best practices. Items were written to measure the teamwork KSA content domains. After piloting and pruning poorly performing items, a final scale consisting of 15 items remained. CFAs were used to test various measurement models that were predicted to be representative of both interpersonal skills and self-management skills. Results demonstrated that

a three-factor model of interpersonal skills and a one-factor model of self-management skills best fit the data. These results suggest that the first objective of the current research was successful.

The second objective of the current research was to test the predictive validity of the new 15-TKT. To this end, a multiple regression analysis was used to test whether overall team performance scores could be predicted from interpersonal and self-management skills subscales of the 15-TKT. Results were nonsignificant, indicating no evidence supporting the predictive validity of the 15-TKT.

The third objective of the current research was to examine whether the relation between teamwork KSAs and teamwork performance was dependent upon the type of team. However, given that no main effects were detected in Study 2, moderator analyses were not conducted. Hence, the question regarding the transportability of the teamwork KSAs described here remains unanswered. This finding is disappointing because it would have been the first known empirical evidence demonstrating that generic, transportable teamwork KSAs exist.

Several factors were discussed that could be contributing to the lack of significant results. Measurement of the dependent variable (overall team performance) consisted of a single-item measure and likely lacked the variance that would be required to detect meaningful differences. Range restrictions in the dependent or independent variable were likely having a suppressive effect on the population parameter estimates. The sample size (N = 25) in Study 2 was small. As such, it is likely that the study lacked sufficient power to identify even moderate effect sizes.

Despite these shortcomings, the current research makes important theoretical contributions to the existing team-selection literature. First, the underlying factor structure of the teamwork KSAs identified by Stevens and Campion (1994) was heretofore untested. Results

here provide the first empirical support that items written to measure interpersonal and self-management KSAs do, in fact, represent an adequate measurement model of the content areas.

Second, the newly developed measure of teamwork KSAs (the 15-TKT) represents an improvement over the existing measure in terms of content validity. Items were written for the 15-TKT to directly tap into the various teamwork-related KSA areas. This is in contrast to the Stevens and Campion's (1999) approach that did not explicitly align items to content (O'Neill et al., 2012).

Finally, the internal consistency estimates for the new 15-TKT (α = .92 to .93) were substantially better (and consistent) than estimates from the original Stevens and Campion (1999) 15-TKT (which ranged from .59 to .70). Demonstrating acceptable levels of internal consistency is an important part of scale development because it speaks to the amount of random error associated with scores from the measure, and thus to the precision and trustworthiness of measurement obtained. Given that the 15-TKT may be used for personnel selection purposes (a high-stakes testing context), high internal consistency of any scales used is warranted.

A new, more reliable and content-valid measure of teamwork KSAs also has practical implications. First, given the improved reliability associated with the 15-TKT, researchers may be more confident about the precision with which they are measuring the underlying transportable teamwork constructs.

Second, given a more psychometrically sound measure of teamwork capability; human resources practitioners may feel confident using the 15-TKT as part of their personnel selection instruments. Assuming future work can improve the overall predictive validity of the 15-TKT, it could be used as a tool to discriminate between job applicants for jobs that require high-levels of teamwork. Improved internal consistency improves the ability to conclude that cross-candidate

differences can be attributed to meaningful differences in the construct of measure. This not only improves the precision of the selection process, but fairness and defensibility of the system.

A more reliable and valid teamwork KSA test would also offer organizations an alternative to the Stevens and Campion (1999) Teamwork KSA Test which, as described above, has been shown to have lower-than-desirable and inconsistent validity coefficients and is lacking evidence of good psychometric structure. Given the heavy reliance on teams in organizations, a solid tool is needed to assist organizations with team-related decisions.

The current research must also be considered in light of several limitations as described above in Studies 1 and 2. First, the sample size associated with Study 2 was small. This may have contributed to insignificant relation between the predictor and criterion variables. Future research should increase the number of participants to increase the overall power of the investigations.

Second, the Study 2 utilized a single-item measure of overall team performance as the dependent variable. As discussed above, debate exists as to the efficacy of single-item measures, but future research should consider expanding the dependent variable measure to more specifically include all of the teamwork KSA domains. Stevens and Campion (1999) used a multi-item performance measure of teamwork, and attempts were made by this studies' author to obtain copies of the scale(s) for use in the current research. However, several requests made by this author to obtain the measure were unanswered. Stevens and Campion (1999) also utilized a peer rating system so that teamwork performance ratings could be obtained from multiple sources. The current research sought to develop a similar peer-rating scale, but union representatives expressed concerns about ranking employee skill and abilities based on an unproven rating scale. Thus, for expedience purposes, the idea to obtain peer ratings of team

performance was abandoned. Future work should consider ways to overcome these challenges so that better measures of the teamwork performance criterion can be utilized.

A final limitation concerns the cross-sectional nature of the current research. All study participants responded to items at one discrete point in time, therefore any estimates of the tests' test-retest reliability was not possible. The 15-TKT was designed to measure relatively stable characteristics of individuals relative to their abilities to work effectively in a team. Administering the 15-TKT to the same group of participants over time (and obtaining similar scores) would be evidence in support of the trait-like nature of team skills. Inconsistent test-retest scores, on the other hand, would raise questions about the underlying teamwork theory.

In addition to the advantages of a reliable and valid self-report test to assess teamwork competence, there may be other ways teamwork KSAs could be measured for selection purposes. For example, researchers could capitalize on recent technological advancements to build an avatar-based computer simulation system. Limited evidence exists for the use of computer simulations for selection purposes (Tippins, 2015) however, simulations have been shown to be effective in other contexts like training delivery (Brannick et al., 2005; Salas, Wilson, Priest, & Guthrie, 2006). It seems plausible that technology could be used similarly for personnel selection purposes as well.

Assessment centers may also be an effective way to measure teamwork KSAs. Researchers have had success using group exercises to measure leadership and other kinds of social skills (see Gaugler, Rosenthal, Thornton, & Benston, 1987) so it seems likely that team exercises like group problem solving could be altered in order to measure and score teamwork KSAs.

Several other considerations are salient for future research as well. First, despite the reality that KSA-based selection systems predict job performance better than personality based models, there is no reason that teamwork KSAs and personality factors couldn't be considered together. As discussed earlier, trait level agreeableness and teamwork orientation have shown consistent and modest associations with team performance. Thus, future work should explore prediction models that include personality, KSAs, and even standard measures of general mental ability.

Related, future research should purposely theorize and then test the overall nomological network of constructs that may be related to the 15-TKT in various ways. This is a process that occurs over time and through various research programs, and is considered an essential part of scale development and construct validation processes (Campbell & Fiske, 1959; Hinkin, 1995).

Second, much of the current research on teams highlights the importance of temporal dynamics in team function (Salas et al., 2018). One important question that remains unexplored is whether and how teamwork dimensions vary over time. For example, are certain KSAs or personality dimensions more important for team performance when teams are newly forming versus when they are mature? Identifying KSAs or other individual characteristics that are associated with successful team formation is an important direction for future research.

Third, an important finding from Stevens and Campion (1999) was that scores on their original Teamwork KSA Test were highly correlated with general mental ability (GMA). An interesting and important line of future validity research for the new 15-TKT would be to evaluate scores in concert with scores from tests of GMA. Demonstrating that the 15-TKT predicted significant and unique variance over and above GMA, would be meaningful for researchers and practitioners alike.

Finally, team fit is another important direction for future teams research (Salas et al., 2018). It seems likely that a balance of team member characteristics would be associated with higher team performance. For example, perhaps overreliance on goal setting techniques (a self-management KSA in the current model) could impede performance of creative teams tasked with developing a new marketing campaign. Some research suggests an association between over reliance on goal setting and many negative outcomes including unethical behavior, reduced intrinsic motivation, and inhibited learning (Ordóñez & Schweitzer, 2009). Similar associations may exist for other teamwork KSAs.

Conclusion

An adage from within team research is that a team of experts does not necessarily translate into an expert team. Overall, the current research sought contribute to the field by identifying and highlighting characteristics of a team that *do* make them great. This research established a measurement tool with improved content validity and internal consistency than the putative measure (Stevens and Campion, 1999). Future would should build on this foundation by the investigating predictive validity of this new tool using larger and more diverse samples to establish whether or not this new tool offers practical improvement for human resource practitioners for making decisions about team-based staffing within their organizations.

Chapter 8 - References

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Appendix A - The Team KSA Test (15-TKT)

1. Coworkers have often told me that I am open and accepting of other people at work
2. My coworkers have often told me that they feel I respect their opinions
3. During meetings at work I have frequently asked for input from team members to solve problems at work
4. While at work, I have frequently engaged teams of people in discussion to solve specific problems
5. During group discussions at work, I have consistently made efforts to ensure that everyone in the group has an opportunity to share their perspective
6. My teammates have often asked me to help resolve issues between coworkers
7. When conflict between coworkers has occurred, I have known what to do to successfully resolve the situation
8. I have been highly successful resolving conflicts with coworkers
9. I have often given constructive feedback about work performance to my coworkers and/or teammates
10. When setting up a new project at work, I have emphasized clearly defining tasks so the team knows exactly what needs to be done
11. When beginning a new project at work, I have always made sure the roles and responsibilities of teammates are clear and understood
12. When I have set goals for myself at work, I made sure they were challenging but realistic
13. When I set up work goals for my team, I made sure the goals were challenging but still attainable
14. When I have set up work goals for my team, I set specific timeframes for completion
15. To improve the performance of my teammates at work, I have routinely given them specific feedback about what they are doing well