

DO TEAM MEMBERS NEED TO KNOW HOW TO FUNCTION AS A TEAM?
THE RELATIONSHIP BETWEEN TEAMWORK KNOWLEDGE AND TEAMWORK
BEHAVIOR

by

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I dedicate this research to God and my family
who have been there for me throughout this journey.

졸업 논문이 완성되기까지 나의 힘이 되신 하나님과
기도로 함께 해준 가족들에게 이 연구를 바칩니다.

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ABSTRACT

The purpose of this study was to examine the impact of having teamwork knowledge on teamwork behavior. This relationship was examined across all team members and also for the most critical team member (i.e., core role holder). This study utilized the Teamwork SJT scale to measure teamwork knowledge, and CATME-B, Individual Performance Measure, Transition Teamwork, and Teamwork Questionnaire to measure teamwork behavior. Multilevel regression and correlation analyses were conducted to examine the main hypotheses. In general, the results indicated that having teamwork knowledge did not have an impact on individual teamwork behavior or team-level teamwork behavior. Only core member's Teamwork SJT scores, specifically, showed a positive relationship with observer-rated teamwork performance scores. Overall, the findings suggested that Teamwork SJT not be used for selection due to its low criterion validity, in spite of its good construct validity.

TABLE OF CONTENTS

	Page
LIST OF FIGURES	vii
LIST OF TABLES	viii
CHAPTER I : INTRODUCTION AND LITERATURE REVIEW	1
Teamwork Theory	2
Measurement of Teamwork Behavior	8
Teamwork Knowledge	11
Core Roles	16
Purpose of the Present Study	17
Hypothesis	17
CHAPTER II: METHOD	19
Participants	19
Procedure	19
Flight Operations Center Simulations	20
Measures	21
Measure of Teamwork Knowledge	21
Measure of Teamwork Behavior	23
CATME-B	23
Observer-Rated Action-Phase Teamwork	24
Observer-Rated Transition Teamwork	25
Member-Rated Teamwork Questionnaire	26

Core Member.....	26
Analytic Approach	27
CHAPTER III: RESULTS	28
Reliability Analysis	28
Preliminary Analysis	29
Hypothesis 1	31
Hypothesis 2	32
Hypothesis 3	33
Hypothesis 4	34
CHAPTER IV: DISCUSSION	36
Implications of the Results	39
Limitation and Future Research	39
Conclusion	41
REFERENCES	42
APPENDICES	51
APPENDIX A: IRB Approval Letter	52
APPENDIX B: Teamwork Situational Judgment Test	54
APPENDIX C: Comprehensive Assessment of Team Member Effectiveness (CATME-B)	68
APPENDIX D: Individual Performance Measure	72
APPENDIX E: Transition Teamwork & Transition Performance	79
APPENDIX F: Teamwork Questionnaire	81

LIST OF FIGURES

Figure 1. Schematic Representation of the Hierarchical Conceptual Structure of Teamwork Behaviors	9
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LIST OF TABLES

Table 1. Taxonomy of Team Processes	6
Table 2. Cronbach's Alpha for All Measures	28
Table 3. Descriptive Statistics of Measures by Positions (Individual Level)	29
Table 4. Descriptive Statistics of Measures (Team Level)	30
Table 5. Pearson Correlation Matrix among Measures of Teamwork Behavior at the Team Level	31
Table 6. Pearson Correlation Matrix between Teamwork SJT and the Measures of Teamwork Behavior at the Team Level	34
Table 7. Pearson Correlation Matrix between Core Member's Teamwork SJT Score and His/Her Team's Scores on the Measures of Teamwork Behavior	35

CHAPTER I: INTRODUCTION AND LITERATURE REVIEW

In today's society, countless factors, such as competition at an international level, the need to meet the demands of customers consistently and efficiently, and fast changes in technology, make organizations face incredible challenges (Salas et al., 2008).

Organizational success largely depends on its adaptability, problem-solving, and collaboration skills. Thus, work teams have been commonly used in the contemporary organizational structures to increase the abilities to adapt, solve complex problems, and collaborate effectively (DeChurch & Mesmer-Magnus, 2010; Devine, Clayton, Philips, Dunford, & Melner, 1999).

Working as a team has many advantages, including higher levels of productivity, innovation, and employee satisfaction (Katzenbach & Smith, 1993). However, the implementation of work teams does not always guarantee achievement of organizational success (Allen & Hecht, 2004). Previous research showed that teams consisting of members with certain characteristics demonstrated better performance. These characteristics include high cognitive ability (Devine & Philips, 2001), several personality traits such as conscientiousness and extraversion (Morgeson, Reider, & Campion, 2005), task-related knowledge (J. E. Mathieu & Schulze, 2006), and job-relevant skills (Neuman & Wright, 1999).

It may be tempting to assume that a team consisting of multiple conscientious individuals with high cognitive ability and job-related knowledge and skills will always achieve excellent team performance. However, simply compiling outstanding team members does not necessarily ensure the formation of the best team; indeed, the members

must collaborate as a unit (Burke, Salas, Wilson-Donnelly, & Priest, 2004; Rentsch, Heffner, & Duffy, 1994). Therefore, team members need to possess not only task-related knowledge and skills, but also teamwork-related knowledge, skills, and behaviors (LePine, Hanson, Borman, & Motowidlo, 2000). Both taskwork and teamwork affect team effectiveness, but they are two different concepts that need to be distinguished. Teamwork can be defined as the coordination of all individual contributions made by team members, while taskwork refers to the work that can be individually done by each member of a team (Crawford & LePine, 2013). In the team process literature, Crawford and LePine (2013) emphasized that not only taskwork but also teamwork is very important for effective group performance.

Teamwork Theory

As mentioned earlier, team-oriented work structures are generally more effective than individual work structures (Hoegl & Gemuenden, 2001). Thus, work teams have gradually become more prevalent in many organizations (Cohen & Bailey, 1997). Along with the increased use of teams in organizations, research interest in team effectiveness has grown (Devine et al., 1999), and many researchers have examined numerous variables associated with team effectiveness. The related variables varied from the organization-wide work team support, such as having a training and reward system (Hyatt & Ruddy, 1997), composition of a team, such as team member diversity (Carpenter, 2002), characteristics of team members, such as personality and cognitive ability (LePine, 2003), team processes, such as communication among team members

(Jordan, Feild, & Armenakis, 2002), to behaviors of team members, such as social loafing (Latane, Williams, & Harkings, 1979).

Many theoretical models of team performance are based on the IMO (Input → Mediating Mechanism → Output) approach, which previously used to be called as an input-process-outcome (IPO) framework. Inputs refer to “conditions that exist prior to a performance episode and may include member, team, and organizational characteristics;” outputs are “results and by-products of team activity that are valued by one or more constituencies, such as managers, customers, and team members” (Rousseau et al., 2006, p. 541). Mediating mechanisms (or processes) illustrate how team inputs are transformed into outputs for task accomplishment (Mathieu, Gallagher, Domingo, & Klock, 2019). Thus, the IMO approach interprets processes as mediating mechanisms, linking member, team, and organizational attributes with performance criteria. The mediating mechanisms include behavioral, cognitive, and affective phenomena within teams (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Marks, Mathieu, & Zaccaro, 2001). Among the mediating mechanisms, behaviors of individuals are distinct from other individual characteristics. Behaviors are directly observable and measurable, while other individual characteristics, such as cognitions and feelings, are not. In addition, cognitions and feelings must be translated into behaviors in order to have an effect on the social and physical environment, because they are internal to the individuals, whereas behaviors are able to directly affect the environment.

Because of the observable and measurable features of behaviors, researchers concentrated on the role of team members' behaviors to increase team effectiveness, and

classified members' behaviors into two main categories: taskwork behaviors and teamwork behaviors (Morgan, Glickman, Woodard, Blaiwes, & Salas, 1986). Taskwork behaviors represent operations-related activities performed by team members (Morgan, Salas, & Glickman, 1993). They are required to perform specific tasks that exist in an organization; thus, they directly contribute to the task accomplishment of individuals working alone or as part of a team. Taskwork behaviors may not be generalized to other team tasks. On the other hand, teamwork behaviors involve "the overt actions and verbal statements displayed during interactions between team members to ensure a successful collective action" (Rousseau et al., 2006, p. 542). Thus, teamwork behaviors are inherent to the existence of teams, and are required for effective team performance (Taggar & Brown, 2001). Indeed, many researchers have found that teamwork behaviors increase team performance by facilitating collective task accomplishments (Bowers, Morgan, Salas, & Prince, 1993; Smith-Jentsch, Johnston, & Payne, 1998). Stevens and Campion (1994) found that teams consisting of members with teamwork related knowledge, skills, and abilities (KSAs) should collectively understand types of interpersonal activities needed, and demonstrate appropriate team member behaviors based on their KSAs; consequently, that leads the team to be effective. Effective teamwork leads to group and organizational effectiveness (Salas, Stagl, Burke, & Goodwin, 2007). A meta-analysis found a consistent relationship between teamwork and team performance; overall teamwork and the ten dimensions of teamwork identified by Marks et al. (2001) were associated with team performance (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008).

Many researchers have attempted to develop models of teamwork process (Marks et al., 2001; Rousseau et al., 2006; Salas, Sims, & Burke, 2005). Marks and colleagues defined teamwork process as “members’ interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals” (p. 357). They developed a hierarchical taxonomy of teamwork behaviors by identifying ten specific processes. The ten facets fell into one of three process categories: transition process, action process, and interpersonal process. Action processes occur when team members are actively engaging in activities directly related to accomplish the tasks. Action processes include monitoring process towards goals, system monitoring, team monitoring and backup behavior, and coordination. Transition processes involve planning and evaluating activities that occur before and after action processes. Specific transition processes include mission analysis, goal specification, and strategy formulation. Interpersonal processes, including conflict management, motivation and confidence building, and affect management, can occur during both transition and action phases. Overall, the three dimensions that included the 10 sub-facets denoted a comprehensive description of teamwork. Refer to Table 1 for definitions of teamwork process dimensions.

Salas, Sims, and Burke (2005), on the other hand, proposed five facets of teamwork: team leadership, mutual performance monitoring, backup behavior, adaptability, and team orientation. Team leadership referred to appropriately directing and coordinating activities of other team members through assigning tasks, developing team knowledge, skills, and abilities, motivating team members, and establishing

Table 1.

Taxonomy of Team Processes

Process Dimensions	Definition
<u>Transition Process</u>	
Mission analysis	Interpretation and evaluation of the team's mission, including identification of its main tasks as well as the operative environmental conditions and team resources available for mission execution
Goal specification	Identification and prioritization of goals and sub-goals for mission accomplishment
Strategy formulation	Development of alternative courses of action for mission accomplishment
<u>Action Process</u>	
Monitoring progress toward goals	Tracking task and progress toward mission accomplishment, interpreting system information in terms of what needs to be accomplished for goal attainment, and transmitting progress to team members
Systems monitoring	Tracking team resources and environmental conditions as they related to mission accomplishment, which involves (1) internal systems monitoring (tracking team resources such as personnel, equipment, and other information that is generated or contained within the team), and (2) environmental monitoring (tracking the environmental conditions relevant to the team)
Team monitoring and backup behavior	Assisting team members to perform their tasks. Assistance may occur by (1) providing a teammate verbal feedback or coaching, (2) helping a teammate behaviorally in carrying out actions, or (3) assuming and completing a task for a teammate
Coordination	Orchestrating the sequence and timing of interdependent actions
<u>Interpersonal Process</u>	
Conflict management	Preemptive conflict management involves establishing conditions to prevent, control, or guide team conflict before it occurs. Reactive conflict management involves working through task and interpersonal disagreements among team members
Motivation and confidence building	Generating and preserving a sense of collective confidence, motivation, and task-based cohesion with regard to mission accomplishment

(Table continues)

Table 1.

Taxonomy of Team Processes (cont.)

Process Dimensions	Definition
Affect management	Regulating member emotions during mission accomplishment, including (but not limited to) social cohesion, frustration, and excitement

Note. The table was reprinted from Marks, Mathieu, & Zaccaro (2001)

a positive atmosphere. The leadership authority may be delegated to one team member or distributed among team members. Mutual performance monitoring involved developing strategies to maintain an awareness of teammate performance. Backup behavior was providing feedback or assistance as needed, as well as shifting workload among teammates under pressure and high workload. Adaptability involved adjusting strategies in response to changing conditions. Lastly, team orientation referred to taking team members' behaviors into account during team process and putting team goals ahead of individual goals.

To define a structure of teamwork behaviors, Rousseau, Aube, and Savoie (2006) proposed a hierarchical model of teamwork behaviors by integrating 29 existing frameworks on teamwork behaviors. In their proposed framework, teamwork behavior was classified under two large dimensions: management of team maintenance and regulation of team performance. While maintaining a team, some personal or interpersonal issues, such as personal difficulties and conflicts between team members, can occur. These issues may distract team members from focusing on team tasks; thus, they need to be resolved to increase team effectiveness. When team members go through personal difficulties, active psychological support from their fellow team members help

them to overcome the difficulties. Additionally, intrateam conflicts are almost inevitable, because individuals with different personalities and perspectives compose work teams. When conflicts among team members emerge, it is necessary to integrate team members' interests, and resolve disagreements and friction (i.e., integrative conflict management).

Another first-order category of teamwork behavior identified by Rousseau and colleagues (2006) is regulation of team performance, based on the action regulation theory by Frese and Zapf (1994). The theory postulates that individuals can achieve high performance if they follow regulation functions of preparation, execution, evaluation, and adjustment. On the basis of the action regulation theory, regulation of team performance can be applied in the order of 1) preparation of work accomplishment, including team mission analysis, goal specification, and planning, 2) task-related collaborative behaviors, including coordination, cooperation, and information exchange, 3) work assessment behaviors, including performance monitoring and systems monitoring, and 4) team adjustment behaviors, including backing up behaviors, intrateam coaching, and collaborative problem solving, and team practice innovation. Rousseau et al. suggested that the functions of preparation, execution, evaluation, and adjustment not only occur in a sequential fashion, but also can be cyclical, repeated until a task-related goal is achieved. See Figure 1 for the overall integrative teamwork behavior structure.

Measurement of Teamwork Behavior

Loughry, Ohland, and Moore (2007) also attempted to describe and categorize team member behaviors to attain and assess team effectiveness. The researchers created potential items based on the previous teamwork literature and tested the items through

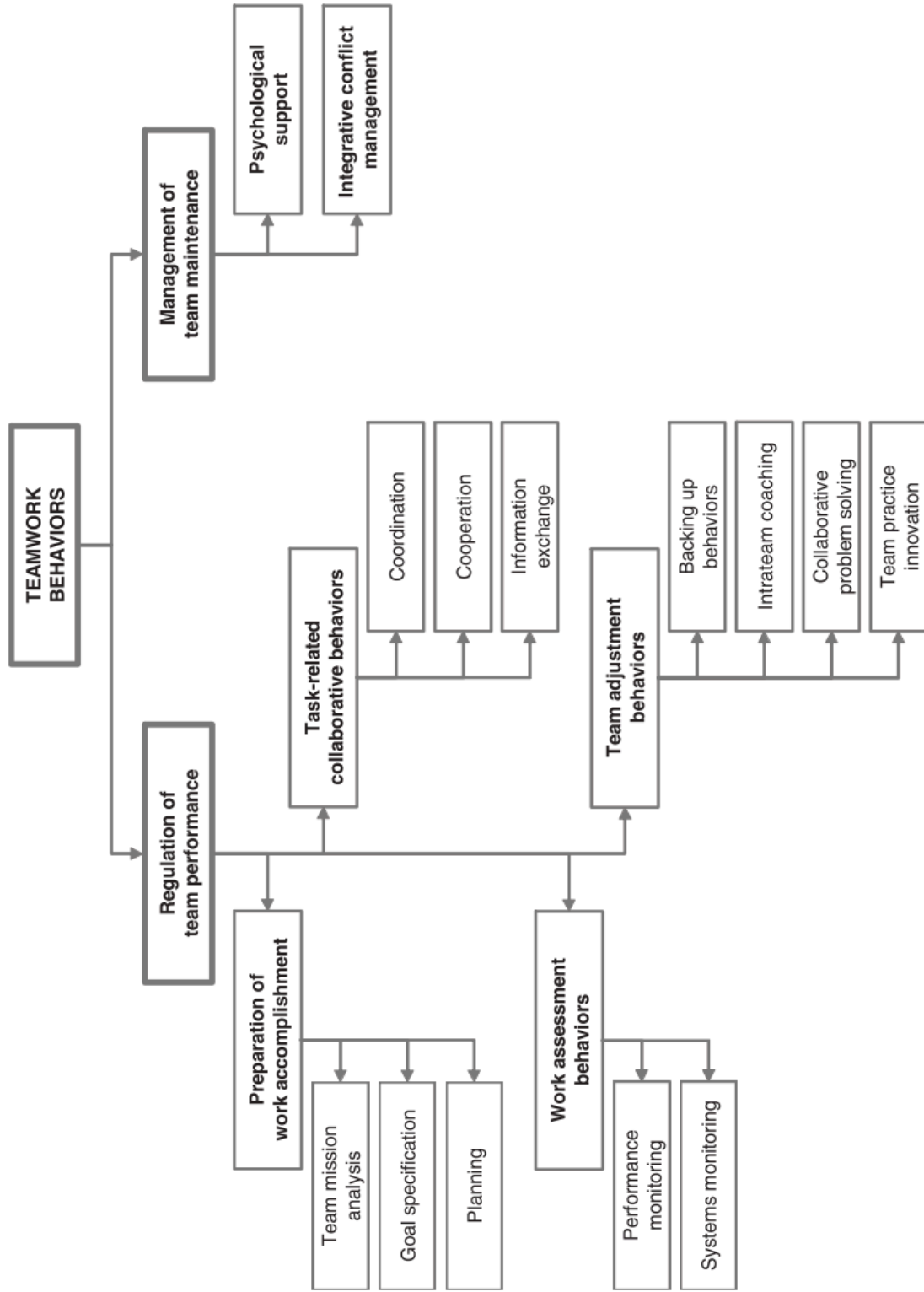


Figure 1. Schematic Representation of the Hierarchical Conceptual Structure of Teamwork Behaviors (Rousseau et al., 2006)

two surveys of college students. They conducted both exploratory and confirmatory factor analysis to find the best fit model of team member behaviors. The authors found 29 types of team member contributions, and these teamwork contributions were divided into five broad categories: Contributing to the Team's Work, Interacting with Teammates, Keeping the Team on Track, Expecting Quality, and Having Relevant Knowledge, Skills, and Abilities. Based on the five-factor model of team member behaviors, Loughry et al. published the Comprehensive Assessment of Team Member Effectiveness (CATME) instrument, using Likert scales ranged from 1 (strongly disagree) to 7 (strongly agree). Using the CATME, each member evaluates the contributions of his or her team members and himself or herself to teamwork. This mutual self- and peer- evaluation by team members helps to increase the accuracy of team member contribution ratings; however, it may limit a general use of the instrument (Ohland et al., 2012). Even a short version of CATME, consisting of 33 items, would make it harder to administer, because each team member must complete 132 (33 x 4) independent ratings in 4-person teams. Another problem of the CATME instrument was that each team member may have different standards for team member contributions when using the Liker-scale format (Ohland et al., 2012).

To overcome these limitations, Ohland et al. (2012) developed the CATME with a behaviorally anchored rating scale (BARS) instrument, referred to as CATME-B. Team members are provided behavioral descriptions for the five dimensions of team member contributions that would anchor excellent (5 on the 5-point scale), medium (3 on the 5-point scale), and poor (1 on the 5-point scale) performances. The CATME-B is easier to

administer, because each team member needs to complete 20 (5 x 4) ratings in 4-person teams. With the given descriptions of behaviors that a team member would display for each team member behavior, all team members would make more consistent ratings, because those behavioral descriptions would serve as a frame of reference. Although the instrument had a problem of range restriction (i.e., overall lenient ratings), it still showed good concurrent and construct validities (Ohland et al., 2012).

Teamwork Knowledge

Each individual often has a different level of teamwork knowledge. Research has shown that teamwork knowledge was positively related to team performance (McClough & Rogelberg, 2003). This suggests that team members who had a higher level of teamwork knowledge demonstrated greater teamwork effectiveness (Hirschfeld, Jordan, Feild, Giles, & Armenakis, 2006). Therefore, it would be critical for team success, and further organizational effectiveness, to select employees having greater mastery of teamwork knowledge and skills. A national survey of employers of college graduates also disclosed that the most essential competency for new hires was the ability to work in a team-structured environment (National Association of Colleges and Employers, 2013).

Given the important role of team composition, many measurement tools to identify individuals' teamwork knowledge and skills have been developed. The Teamwork Knowledge, Skills, and Ability Test (Teamwork KSA) developed by Stevens and Campion (1994) is one of the major works in this area. The Teamwork KSA Test was designed to assess individual's knowledge, skills, and abilities (KSAs). Stevens and Campion (1994) focused on individual-level knowledge of appropriate behaviors for

teamwork rather than personality traits, or technical KSAs. The specific teamwork KSAs were categorized to two main categories (i.e., interpersonal KSAs and self-management KSAs), with five subcategories and 14 specific KSAs. In the same article that proposed the teamwork KSAs, Stevens and Campion (1994) developed an instrument with 35 multiple choice items based on the fourteen KSA requirements for teamwork, including conflict resolution, collaborative problem solving, communication, goal setting and performance management, and planning and task coordination. Findings from two validation studies indicated that Teamwork KSA Test provided incremental validity over traditional employment aptitude tests (Stevens & Campion, 1999). In addition, the Teamwork KSA Test possessed high face validity, and items were not readily fakeable (Stevens & Campion, 1994). However, the Teamwork KSA Test held some limitations. For example, even though the test was focused on the individual level of teamwork KSAs, interpretation was often based on the overall teamwork KSA at the team level (Miller, 2001). While the Teamwork KSA Test scores were designed to assess teamwork knowledge, the test was highly correlated team member's cognitive ability as well (McClough & Rogelberg, 2003; Stevens & Campion, 1999). Further, the instrument has also been criticized due to its less focus on teamwork skills and abilities, compared to teamwork knowledge, and low internal consistency of the measure (Aguado, Rico, Sanchez-Manzanares, & Salas, 2014).

In order to overcome these limitations, Aguado and colleagues (2014) recently developed the Teamwork Competency Test (TWCT) based on the Stevens and Campion's (1994) 14 dimensions of teamwork KSAs. Unlike the Stevens and Campion's

14 dimension for teamwork, Aguado et al. (2014) proposed eight teamwork factors falling under two general dimensions (interpersonal and self-management KSAs). Interpersonal KSAs include conflict resolution, collaborative problem solving at the group level, collaborative problem solving at the individual level, active listening, and informal communication. The second dimension, self-management KSAs, involves planning, performance objective management via monitoring, and performance objective management via feedback. The TWCT has shown improved reliability and content coverage compared to the Teamwork KSA Test (Aguado et al., 2014). However, the test was in the form of self-reporting such as “I plan my tasks effectively” and “I often provide my peers with feedback on their task performance”. This could cause a social desirability problem, and socially desirable responding may become a threat to its validity in some situations such as selection (Van de Mortel, 2008). Another limitation of the TWCT was the lack of empirical evidence for discriminant validity; that is, Aguado and colleagues did not provide any evidence that the test was not highly correlated with cognitive ability (Littlepage et al., 2015). Lastly, even though it showed better content coverage than the Teamwork KSA test, the TWCT was still missing some aspects of teamwork (Littlepage et al., 2015), which were predominant in recent teamwork models (e.g., Marks et al., 2001; Salas et al., 2005), and should have been included in teamwork knowledge measures.

Another popular form of selection measurement often used is situational judgment test. In a situational judgment test (SJT), individuals are given a hypothetical situation that they might face on their job, and asked what they would (or should) do in the given

situation (Weekley & Jones, 1999). The SJT predicts individual's future behaviors and performance based on the individual's past behaviors and attitudes (Ployhart & Ehrhart, 2003). A meta-analysis of SJTs found that SJTs have relatively strong validities for overall performance, offer a convenient method for sampling participants' performance on complex tasks, and are well suited to measure behaviors in complex administrative and interpersonal situations, providing ambient details of contextual features (Christian, Edwards, & Bradley, 2010). In addition, SJTs usually have a lower cost of administration and scoring than high-fidelity simulations such as work samples and assessment centers (Motowidlo, Dunnette, & Carter, 1990; Weekley & Jones, 1999).

Based on the merits of SJTs, a different approach from the Teamwork KSA was taken by Mumford, Iddekinge, Morgeson, and Campion (2008) to overcome the high correlation between teamwork knowledge and cognitive ability of previous measures. They created the Team Role Test (TRT), a situational judgment test, asking participants to rate the effectiveness of various responses for each scenario. The TRT measures teamwork knowledge by asking appropriate behaviors for various team roles. The TRT scores indicate team members' knowledge of teamwork behaviors for various team roles, including coordinator, critic, and contributor. In general, the test was reliable, not highly correlated with cognitive ability or personality, and a better alternative to individual difference variables as a predictor of team role performance (Mumford et al., 2008). However, the roles in the TRT did not fully cover all aspects of teamwork; in other words, some roles reflected task-oriented behaviors instead of teamwork behaviors and failed to emphasize specific teamwork behaviors such as backup behavior, and resource

monitoring. Thus, while the TRT seemed to be a valid predictor of the understanding of team role behaviors, it did not adequately evaluate teamwork knowledge and skills. Additionally, the TWCT was still missing some aspects of teamwork (Aguado et al., 2014), which were predominant in recent teamwork models (e.g., Marks et al., 2001; Salas et al., 2005).

In order to overcome the limitations of the previous tests of teamwork knowledge, skills, and abilities, the Teamwork Situational Judgment Test (Teamwork SJT) was developed by Littlepage and colleagues (Littlepage et al., 2015). The Teamwork SJT measures teamwork knowledge with 10 different scenarios; a scenario was designed to reflect each teamwork dimension (mission analysis, goal specification, strategy formulation, monitoring progress towards goals, system monitoring, team monitoring and backup behavior, coordination, conflict management, motivation and confidence building, and affect management) identified by Marks et al. (2001). In each situation, six potential actions that could be taken were presented; two of them were effective behaviors, two were ineffective responses, and the remaining two were marginally effective. Individuals should rate how likely they would potentially take each action in response to the scenario. Findings indicated that the Teamwork SJT was a reliable and construct valid instrument, was weakly correlated with cognitive ability tests and personality tests, established discriminant validity, and did not appear to have the social desirability issues (Littlepage et al., 2015; Steffensen, 2014). A limitation of the Teamwork SJT is that criterion validity has not been established yet. Overall, the

Teamwork SJT may be a promising alternative to other instruments of teamwork knowledge such as the Teamwork KSA, TWCT, and TRT.

Core Roles

Within a team, each team member may be expected to have different roles from other team members. Generally, each role has a different level of criticality in terms of team effectiveness. According to a study conducted by Humphrey, Morgeson, and Mannor, (2009), some roles in a team were more important than others, and these roles were named as “the strategic core” in their literature. A person occupying these roles is now commonly called as a critical (or core) team member. His or her position would not be easily replaced and could not be completed by any other teammates (Brass, 1984). Critical members may significantly influence a number of different outcomes of the team, because the team’s ability to complete its task would depend on the most critical member’s power and capacity (Salancik & Pfeffer, 1977). For instance, knowledge held by the most critical team member contributed the most to team effectiveness (Brass, 1984; Ellis, Bell, Ployhart, & Hollenbeck, 2005). Humphrey et al. (2009) also demonstrated that “certain team roles are most important for team performance and that the characteristics of the role holders in the ‘core’ of the team are more important for overall team performance” (p. 48). It also turned out that the relationship between teamwork processes and team performance was moderated by the number of core team members within a team (LePine et al., 2008). For these reasons, teamwork behavior of core role holders may be especially important, and their teamwork KSAs may contribute the most to enabling effective teamwork behaviors.

Purpose of the Present Study

The current study explored the relationship between teamwork knowledge (using a situational judgment test of teamwork; i.e., Teamwork SJT; Littlepage et al., 2015) and teamwork behaviors. In addition, beyond this commonly examined relationship, the effect of the “coreness” of a role will also be studied.

Hypothesis

Hypothesis 1. At the individual level, teamwork knowledge is positively related to teamwork behavior.

Hypothesis 1a: Individual Teamwork SJT scores are positively related to peer-rated teamwork (3-question composite CATME-B scores).

Hypothesis 1b: Individual Teamwork SJT scores are positively related to observer-rated action-phase teamwork (3 items from individual performance measures).

Hypothesis 2. Teamwork knowledge (Teamwork SJT score) of the core member is positively related to teamwork behavior of the core role-holder.

Hypothesis 2a: Core member Teamwork SJT score is positively related to the core member’s peer-rated teamwork (3-question composite CATME-B score).

Hypothesis 2b: Core member Teamwork SJT score is positively related to observer-rated action-phase teamwork (3 items from individual performance measures) of the core member.

Hypothesis 3. At the team level, there will be a positive correlation between teamwork knowledge and teamwork behavior.

Hypothesis 3a: Aggregated (average) Teamwork SJT scores are positively related to aggregated (average) CATME-B scores.

Hypothesis 3b: Aggregated (average) Teamwork SJT scores are positively related to aggregated (Average) observer-rated action-phase teamwork (3 items from individual performance measures).

Hypothesis 3c: Aggregated (average) Teamwork SJT scores are positively related to observer-rated transition teamwork ratings.

Hypothesis 3d: Aggregated (average) Teamwork SJT scores are positively related to member-rated scores of overall teamwork.

Hypothesis 4. There is a positive relationship between the core member's teamwork knowledge and team-level teamwork behavior.

Hypothesis 4a: Core member Teamwork SJT score is positively related to aggregated (average) CATME-B scores.

Hypothesis 4b: Core member Teamwork SJT score is positively related to aggregated (average) observer-rated action-phase teamwork (3 items from individual performance measures).

Hypothesis 4c: Core member Teamwork SJT score is positively related to observer-rated transition teamwork ratings.

Hypothesis 4d: Core member Teamwork SJT score is positively related to member-rated scores of overall teamwork.

CHAPTER II: METHOD

Participants

Aerospace undergraduate students at Middle Tennessee State University (MTSU) must participate in the NASA Flight Operations Unified Center Simulation (FOCUS) Lab, a senior-level capstone course, for graduation. The participation in research, however, was totally voluntary, and informed consent was obtained for all individual-level surveys. See Appendix A for a copy of the Institutional Review Board approval form.

The FOCUS lab is a simulation laboratory class. The lab is staffed by senior Aerospace students with differing specializations. Each has a specific role such as crew scheduler, weather forecasting, and flight planning. Each team participates in a series of 2.5-hour simulations in which they conduct airline operations involving approximately 60 flight events (takeoffs and landings) and must also deal with non-routine situations. The present study utilized archival research data collected by the FOCUS Lab. In this study, 31 teams, giving 163 participants whose data were assessed, were analyzed. The data were collected across 6 semesters.

Procedure

The data in the FOCUS Lab were previously gathered as follows. Prior to the flight simulations, senior aerospace students who registered for the AERO 4040 course, Aerospace Senior Capstone Lab, participated in onboarding and then were rostered for one of ten key positions on a virtual airline team. In order to increase the fidelity of the flight simulations, the students were given a job orientation, and the main objectives and

expectations for simulations were explained. The students were expected to actively engage in teamwork, follow the Federal Aviation Administration's safety regulations, act professionally and ethically, seek to creatively solve problems, and reach high levels of job performance. These expectations, especially engaging in teamwork behaviors, made the participants more suitable for this study. Then the participants were divided into each team, consisting of primarily ten positions: Flight Operations Coordinator (FOC), Flight Operations Data 1 (FOD 1), Flight Operations Data 2 (FOD 2), Crew Scheduling (CS), Weather and Forecasting (WX), Maintenance Control (MX), Maintenance Planning and Scheduling (MXPS), Pilot (PR), Pseudo Pilot (PsPR), and Ramp Tower (RT). Among the 10 roles, 7 positions situated in close proximity in the center system, including FOC, FOD 1, FOD 2, CS, WX, MX, and MXPS. In the immediate lab, the seven key positions had to utilize face-to-face communication as well as interact electronically to share information, coordinate actions, and perform the team's tasks (Bearden, 2017). Pilots stayed all together in a separate space, and Ramp Tower coordinator also performed his or her duties outside the immediate lab. Recently, Hub Coordinator (HC) position has been added in the central system lab, and interacted with other key positions. This study included only the key positions located in the immediate lab, and interacting not only electronically but also face-to-face, in order to focus on the direct teamwork processes.

Flight Operations Center Simulations. Each team went through three different simulations across a semester, and each simulation lasted about two and a half hours. During each simulation, teams were expected to dispatch flights on time, follow company policies, and adhere to the Federal Aviation Regulations. Teams were also given

multiple non-routine events during each simulation to evaluate the team's troubleshooting abilities. Team members were required to utilize collaboration skills and work together to solve the problems effectively. Example of non-routine events include a passenger heart attack, an engine oil leak, not closed cargo door, not operating flaps, a pilot breaking his or her arm prior to the flight, and an airport security closure.

The FOCUS Lab staff, six to eight people consisting of professors and graduate teaching assistants, observed the simulations to assess individual performance of each team member as well as overall team performance. Lab staffs also judged the adequacy of team responses to the non-routine events. Students could seek out limited help or advice from the lab staff during the simulations. Littlepage, Hein, Moffett, Craig, and Georgiou (2016) provided a more detailed description of the FOCUS Lab.

Measures

Measure of Teamwork Knowledge. Students in the FOCUS Lab were given the Teamwork Situational Judgment Test (Teamwork SJT) before the first simulation and following the final simulation. Teamwork SJT scores taken before the first simulation were used in this study. The Teamwork SJT measure was developed by Littlepage and Master's Candidates of an Industrial/Organizational Psychology program as part of Workgroup Effectiveness class projects (Littlepage et al., 2015). The SJT measures the understanding of teamwork process based on the 10 dimensions of a teamwork process identified by Marks and her colleagues (2001). The measure consisted of 10 scenarios, each describing one of the ten teamwork process dimensions: mission analysis, goal specification, strategy formulation, monitoring progress towards goals, systems

monitoring, team monitoring and backup behavior, coordination, conflict management, motivation and confidence building, and affect manage. For each scenario, participants were faced with a situation and asked to indicate the likelihood of taking the proposed actions. Ratings were made on a Likert scale ranging from Very Unlikely (1) to Very Likely (7). The sample scenario for the team process of goal setting and its subsequent behavioral responses are as follows (see Appendix B for the entire SJT, including each item's corresponding process).

Scenario 1 – Mission Analysis

The CEO of a high-end restaurant chain comes into your office and says that she has a disturbing finding. The service quality of waiters and waitress (servers) is at a two year low, and customers that usually go to your restaurant are going to other places to eat instead. As the Vice President of Human Resources, you are tasked with analyzing the situation and coming up with a solution to improve the server performance. You have decided that the first step to tackle the problem is to create a team of individuals from corporate Human Resources and local managers in the organization that may be useful in solving this issue. Right after forming the team, you are trying to decide what should be your next immediate step in trying to solve this problem.

Please rate each response choice on how likely you would be to take the action(s):

1. Have a team meeting to discuss possible nature of the problem and potential steps that can be taken to improve server performance.
2. Have your team research industry trends to see if they can find any useful information that could be used to identify common problems with server performance.
3. Immediately start to work on the task, leaving everyone to figure out how to accomplish the CEO's goal for themselves.
4. Have your team call managers in various restaurant locations to find out if they understand the nature of the problems in server performance.
5. Have a meeting with your team discuss relevant tasks, challenges, and resources needed to analyze the problem.
6. Fire your old service staff and put your team in charge of hiring new service staff.

Among the six behavioral responses, two actions represented ineffective behavior (response 3 and 6), two moderate behavior (response 2 and 4), and the rest two reflected effective behavior (response 1 and 5). The SJT is scored by subtracting the ratings for ineffective behaviors from effective behaviors and aggregating across items to yield an overall index of teamwork knowledge. For example, in Scenario 1, the sum of Item 3 and Item 6 responses would be subtracted from the sum of Item 1 and Item 5 responses. The highest possible score for a single scenario is 12 (i.e., $[7 + 7] - [1 + 1] = 12$). A composite of the scores on each item is a total score for this SJT; thus, the best possible total score is 120. See Appendix B for the scoring guide of this measure. For team level analyses, an average of team members' Teamwork SJT scores will be calculated, and be used to represent an overall level of teamwork knowledge of each team. Steffensen (2014) reported that Cronbach's alpha for total SJT was between .74 and .89.

Measure of Teamwork Behavior. Teamwork behavior was measured using several different instruments depending on the level of analysis. For the individual level analysis of teamwork behavior, a behaviorally-anchored version of the Comprehensive Assessment of Team Member Effectiveness (CATME-B) developed by Ohland et al. (2012) and Individual Performance Scale developed in the FOCUS Lab was used. At the team level, CATME-B, Individual Performance Measure, Transition Teamwork & Performance, and Teamwork Questionnaire (reflecting the Marks, Mathieu & Zaccarao teamwork dimensions) were used to measure teamwork behavior.

CATME-B. Teamwork behavior was assessed using selected items from the Comprehensive Assessment of Team Member Effectiveness (CATME-B; Ohland et al.

2012). The original CATME-B measures team member's performance at the individual level, and consists of five items about team member effectiveness, including Contribution to the Team's Work, Interaction with Teammates, Keeping the Team on Track, Expecting Quality from the Team, and Having Relevant Knowledge, Skills, and Abilities (KSAs). In the FOCUS Lab, three dimensions of teamwork behavior in the CATME-B were measured: Item 1 – contributions to the team's work, Item 2 – teammate interaction, and Item 5 – possession of related KSAs. Participants were asked to rate their team member's contributions to the team's work, teammate interaction, and possession of related KSAs on a 5 point behaviorally-anchored scale (1 = Excellent, 5 = Below average). The measure of CATME-B used in the FOCUS Lab is provided in Appendix C.

Observer-Rated Action-Phase Teamwork. Action-phase teamwork represents teamwork behavior observed during the simulation. This measure was derived from items embedded in a broader measure of individual performance. The Individual Performance Measure was internally developed by an Industrial/Organizational Psychology Graduate Class as part of a class requirement for the use in the FOCUS Lab, and assessed both taskwork and teamwork. A positional job analysis method was utilized, including questionnaire, observations, and Subject Matter Experts (SMEs) interviews, to create the measure. The process allowed the development of a position-specific performance questionnaire for each role in the FOCUS Lab. For each position within the lab, one to two members of the FOCUS Lab staff were asked to observe during each simulation and complete the Individual Performance measures to best describe that

member's behavior. The FOCUS Lab staff possessed extensive knowledge of roles for each position; thus, they were believed to be SMEs.

The measure includes teamwork performance questions as well as job-specific individual performance questions. The items pertaining to individual task performance consist of five to seven items and differ across positions to reflect position-specific duties. An example item of individual performance measure for the FOC is "Employs proactive strategies to remedy the situation/event that takes place during the simulation." The final three items in the individual performance scale assess member's teamwork-related behaviors, including information flow, information utilization, and coordination. The three items were identically asked across all positions (i.e., not position-specific). These three items provide an assessment of teamwork during the simulation and represent action phase teamwork. In this study, only the three items, common across the positions, were included. All responses were evaluated on a seven-point Likert Scale 1 = *Never* and 7 = *Always*. The measure of Individual Performance Scale is provided in Appendix D.

Observer-Rated Transition Teamwork. Following each After Action Review (AAR) session, the facilitator rated teamwork behaviors during the AAR. In the FOCUS Lab, the Transition Performance (Facilitator) was originally used. This measure is based on Marks, Mathieu, and Zaccaro's teamwork model (2001), and consists of a total of 11 items. Nine out of the eleven items subdivided into 3 categories (Mission Analysis, Goal Specification, and Strategy Formulation and Planning). The three categories had 3 items, respectively. A five-point Likert Scale anchored by 1 = *Not at All* and 5 = *To a Very Great Extent* was used to evaluate each item. Cronbach's alpha of this measure was .88.

Since 2016, this measure has been updated to a 5-item scale. The new scale, Observer-rated Transition Teamwork, was utilized to measure transition teamwork performance. Items assessed mission analysis, goal specification, strategy formulation and planning, and involvement in the AAR. The same five-point response scale was used, anchored by: 1 = *Not at All* and 5 = *To a Great Very Extent*. Only the common three categories between the old and updated scales (Mission Analysis, Goal Specification, and Strategy Formulation and Planning) were included in this study. Throughout this study, Transition Teamwork means the common items from the old and new measures included in this study, unless otherwise noted. See Appendix E for a measure of transition teamwork.

Member-Rated Teamwork Questionnaire. Mathieu and colleagues developed a 30-item self-report Teamwork Questionnaire to assess the model of teamwork process identified by Marks, Mathieu, and Zaccaro (2001; 2019). Team members evaluate their own team's level of mission analysis, goal specification, strategy formulation and planning, monitoring progress toward goals, resources and systems monitoring, team monitoring and backup, coordination, conflict management, motivating and confidence building, and affect management. Each dimension is measured by three items, and a five-point Likert Scale was used, from 1 = *Not at all* to 5 = *To a Very Great Extent*. Mathieu et al. (2019) reported Cronbach's alpha of the scale by each dimension of teamwork process: transition process $\alpha = .96$; action process $\alpha = .91$; and interpersonal process $\alpha = .95$. Teamwork Questionnaire used in this study is presented in Appendix F.

Core Member. Previous research has determined the position of Flight Operations Coordinator (FOC) as the core role within the FOCUS Lab (Turnquest, 2018).

This role required coordination with all other roles and has decision making authority.

The FOC had to manage overall airline operations in order to ensure effective and smooth operations of the airline. The responsibilities included making final decisions related to all flights and clearing all flight departures. Therefore, based on the previous study, FOC was selected as a core person within the team among the ten positions within each team.

Analytic Approach

Data analysis was conducted both at the individual level and at the team level. Preliminary analyses, including descriptive statistics, were conducted to understand characteristics of the sample data. Internal consistency of all rating scales was also examined. Because the FOCUS Lab is highly team-oriented, analyses were conducted to examine if data from individuals are nested within teams, and if multilevel analyses should be considered. Then, in order to test the main hypotheses, multilevel regression and correlation analyses were utilized.

CHAPTER III: RESULTS

Reliability Analysis

An analysis of internal consistency was conducted in SPSS. Cronbach's alpha was calculated for Teamwork SJT as well as the four teamwork behavior measures. Table 2 contains detailed results of the internal consistency analysis. In general, the results indicated that the items of each measure were homogeneous in the construct being assessed. The coefficient alphas of CATME-B ($\alpha = .972$), Individual Performance Measure ($\alpha = .919$) and Teamwork Questionnaire ($\alpha = .967$) were strong. The coefficient alphas of Teamwork SJT and transition teamwork measures ranged from .862 to .897, meaning good internal consistency.

Table 2.

Cronbach's Alpha for All Measures

Measure	Number of Items	Number of Ratings		Cronbach's Alpha
		Individual	Team	
Teamwork SJT	60	158	–	.862
CATME-B	15	68	–	.972
Individual Performance Measure	3	155	–	.919
Observer-rated Transition Teamwork	3	–	6	.897
Transition Performance (Facilitator)	9	–	16	.870
Teamwork Questionnaire	30	136	–	.967

Preliminary Analysis

Table 3 and Table 4 contain descriptive statistics for the scores received on each measure which were used in this study at the individual level and at the team level, respectively. Descriptive statistics at the individual level were subdivided by positions in order to identify core role holder's (i.e., Flight Operations Coordinator [FOC]) scores on each measure.

Table 3.

Descriptive Statistics of Measures by Positions (Individual Level)

Measure	<i>N</i>	<i>M</i>	<i>SD</i>
Teamwork SJT	163	57.07	21.86
FOC	28	58.14	22.35
FOD1	23	48.52	23.91
FOD2	24	58.63	26.60
Crew Scheduling	28	65.79	16.24
Weather and Forecasting	16	55.13	18.97
Maintenance Control	24	56.13	22.63
Maintenance Planning and Scheduling	12	54.42	21.37
Hub Coordinator	8	53.38	15.17
CATME-B	158	4.33	0.44
FOC	28	4.42	0.40
FOD1	29	4.21	0.51
FOD2	29	4.37	0.34
Crew Scheduling	23	4.29	0.43
Weather and Forecasting	29	4.32	0.43
Maintenance Control	12	4.40	0.47
Maintenance Planning and Scheduling	N/A	N/A	N/A
Hub Coordinator	8	4.29	0.62
Individual Performance	148	5.48	1.10
FOC	25	5.17	0.96
FOD1	26	4.73	1.24
FOD2	21	5.73	1.24
Crew Scheduling	21	6.05	1.13
Weather and Forecasting	23	5.83	0.61
Maintenance Control	25	5.63	0.77
Maintenance Planning and Scheduling	N/A	N/A	N/A
Hub Coordinator	7	5.14	1.23

Table 4.

Descriptive Statistics of Measures (Team Level)

Measure	<i>N</i>	<i>M</i>	<i>SD</i>
Teamwork SJT	31	57.02	8.88
CATME-B	29	4.33	0.35
Individual Performance	29	5.44	0.69
Transition Teamwork	28	3.37	0.69
Teamwork Questionnaire	25	3.88	0.58

As a preliminary evaluation of the relationship between teamwork knowledge and teamwork behavior, the relations among the different measures of teamwork behavior were assessed, using correlations. At the individual level, CATME-B and Individual Performance Measure were employed to measure teamwork behavior. Results indicated that there was not a significant relationship between CATME-B and Individual Performance Measure at the individual level, $r(122) = .15, p = .097$. This denoted that team member effectiveness measured by team members was not correlated with teamwork performance measured by observers. At the team level, four scales were used to measure teamwork behavior: CATME-B, Individual Performance Measure, Transition Teamwork, and Teamwork Questionnaire. All the four measures were measuring teamwork behavior; however, only CATME-B and Transition Teamwork scores showed a significant correlation, $r(20) = .49, p = .21$. This indicated that team's average score of team member effectiveness measured by its members was related to the team's transition performance score rated by observers. Table 5 shows the overall result of correlation analysis of teamwork behavior measures at the team level. Overall, these findings indicate a low level of consistency between the various measures of teamwork behavior.

Table 5.

Pearson Correlation Matrix among Measures of Teamwork Behavior at the Team Level

	1	2	3	4
1. CATME-B	–	.26 (<i>N</i> = 27)	.49* (<i>N</i> = 21)	.19 (<i>N</i> = 24)
2. Individual Performance Measure	.26 (<i>N</i> = 27)	–	.31 (<i>N</i> = 21)	.10 (<i>N</i> = 24)
3. Transition Teamwork	.49* (<i>N</i> = 21)	.31 (<i>N</i> = 21)	–	.33 (<i>N</i> = 21)
4. Teamwork Questionnaire	.19 (<i>N</i> = 24)	.10 (<i>N</i> = 24)	.33 (<i>N</i> = 21)	–

*. Correlation is significant at the .05 level (2-tailed).

Hypothesis 1

In Hypothesis 1, it was expected that individual's teamwork knowledge would be positively related to teamwork behavior. Because of the team-based nature of the FOCUS Lab, the individual level teamwork performance data were examined to determine if further multilevel analysis would be needed. Using a “nlme” package in r, intraclass correlation coefficient (ICC) and design effect (DE) were computed. Results indicated that 64% of variance in CATME-B scores was due to variance between teams, $ICC = 0.64$. Design effect was equal to 2.92, greater than rule of thumb of 2 (Lai & Kwok, 2015). The confidence interval of the standard deviation of the random effect did not include 0 (0.25-0.47), meaning that random effect was significantly different from 0. Combining the ICC, design effect, and confidence interval of the random effect, a multilevel analysis was needed to be considered when investigating the relationship between Teamwork SJT and CATME-B scores. On the other hand, the results indicated that only 6% of variance in Individual Performance Measure scores was due to variance between teams, $ICC = 0.02$. Design effect was also less than 2, $DE = 1.06$. Thus, no

further multilevel analysis was considered regarding the relationship between Teamwork SJT and Individual Performance Measure.

Multilevel analysis results demonstrated that the average CATME-B score was 4.27 when Teamwork SJT score was equal to 0 across all teams, $\gamma_{00} = 4.27, p < .001$. The Teamwork SJT score was not a significant predictor for CATME-B score, $\gamma_{10} = 0.0009, p = .45$. The standard deviation of the random effect was 0.35 with 95% confidence interval of [0.26, 0.47]. The random effect indicated that the CATME-B scores varied across teams and the non-significant slope designated that individual level variance in CATME-B scores was not related to Teamwork SJT scores. In other words, the CATME-B scores varied between teams, not by individual Teamwork SJT scores. Therefore, Hypothesis 1a was not supported.

Bivariate Pearson's correlation was computed using SPSS in order to explore the relationship between individual's scores on the Teamwork SJT and the Individual Performance Measure. The correlation coefficient between the two measures was not significant, $r(99) = .05, p = .61$. That means individual's Teamwork SJT scores did not show a meaningful relationship with the individual's scores on Individual Performance Measure. Accordingly, Hypothesis 1b was not supported. In summary, individual Teamwork SJT scores did not appear to be related to individual CATME-B scores or Individual Performance Measure scores.

Hypothesis 2

Hypothesis 2 predicted that core member's knowledge of teamwork would be positively related to teamwork behavior of the core role holder. Bivariate Pearson's correlation was

calculated in SPSS for the rest of the correlation analyses. Hypothesis 2 was partially supported. Core member's score on Teamwork SJT was not correlated with that on CATME-B, $r(23) = -.08, p = .721$. Thus, Hypothesis 2a was not supported. On the other hand, core member's score on Teamwork SJT was positively correlated with that on Individual Performance Measure, $r(20) = .52, p = .016$. Therefore, Hypothesis 2b was supported. This result indicated that for core role holders, the more they had teamwork knowledge, the higher their performance during the simulation was rated. Taken together, core member's knowledge of teamwork was positively related to the core role holder's teamwork behavior when an observer rated members' teamwork performance, but not when members rated each other's teamwork performance.

Hypothesis 3

In Hypothesis 3, it was expected that team's scores on Teamwork SJT would be positively related to the team's scores on the measures of teamwork behavior. The comparisons were conducted at the team level. Correlations between team's average Teamwork SJT scores and the team's scores on teamwork behavior measures were calculated. At the team level, four teamwork behavior measures were used: CATME-B, Individual Performance Measure, Transition Teamwork, and Teamwork Questionnaire. CATME-B and Teamwork Questionnaire were rated by team members, while an observer provided team ratings on Individual Performance Measure and Transition Teamwork. Results indicated that team's Teamwork SJT score was negatively related to the team's Teamwork Questionnaire score, $r(24) = -.43, p = .033$. This suggested that teams obtained lower teamwork performance ratings by team members, as the members

within each team knew better about teamwork processes. There was no significant relationship between team's Teamwork SJT score and the other measures of teamwork behavior, including CATME-B, Individual Performance Measure, and Transition Teamwork. In summary, the Hypothesis 3 was not supported. Table 6 contains the results of correlation analysis between Teamwork SJT and the measures of teamwork behavior at the team level.

Table 6.

Pearson Correlation Matrix between Teamwork SJT and the Measures of Teamwork Behavior at the Team Level

	1	2	3	4	5
1. Teamwork SJT	–	-.21 (N = 29)	-.20 (N = 29)	-.21 (N = 21)	-.43* (N = 25)
2. CATME-B	-.21 (N = 29)	–	.26 (N = 27)	.49* (N = 21)	.19 (N = 24)
3. Individual Performance Measure	-.20 (N = 29)	.26 (N = 27)	–	.31 (N = 21)	.10 (N = 24)
4. Transition Teamwork	-.21 (N = 21)	.49* (N = 21)	.31 (N = 21)	–	.33 (N = 21)
5. Teamwork Questionnaire	-.43* (N = 25)	.19 (N = 24)	.10 (N = 24)	.33 (N = 21)	–

*. Correlation is significant at the .05 level (2-tailed).

Hypothesis 4

Hypothesis 4 predicted that core member's teamwork knowledge would have a positive relationship with his or her team's teamwork behavior. This hypothesis was not supported. Results showed that there was no meaningful correlation between core member's Teamwork SJT scores and his or her team's scores on any of the teamwork behavior measures. Refer to Table 7 for the full results for the correlations between Core member's Teamwork SJT and his or her team's teamwork behavior measures.

Table 7.

Pearson Correlation Matrix between Core Member's Teamwork SJT Score and His/Her Team's Scores on the Measures of Teamwork Behavior

	1	2	3	4	5
1. Core member's Teamwork SJT	–	-.01 (N = 24)	.28 (N = 24)	.04 (N = 24)	-.19 (N = 20)
2. Team's CATME-B	-.01 (N = 24)	–	.18 (N = 26)	.26 (N = 25)	.19 (N = 23)
3. Team's Individual Performance Measure	.28 (N = 24)	.18 (N = 26)	–	.19 (N = 25)	.10 (N = 23)
4. Team's Transition Teamwork	.04 (N = 24)	.26 (N = 25)	.19 (N = 25)	–	.38 (N = 21)
5. Team's Teamwork Questionnaire	-.19 (N = 20)	.19 (N = 23)	.10 (N = 23)	.38 (N = 21)	–

CHAPTER IV: DISCUSSION

As a team-oriented organizational structure has become more prevalent, the importance of understanding how teams work and knowing how to make teams perform better receives the spotlight in both academia and industry. Organizations need to focus on not only individual's knowledge, skill, and ability (KSA) requirements for taskwork, but also individual's KSA requirements for teamwork, in order to make sure the individual can perform effectively in the team-oriented work environment. When individual's teamwork knowledge, skills and abilities need to be identified, the Teamwork KSA scale, developed by Stevens and Campion (1994), has frequently been used. However, the Teamwork KSA was found to be highly correlated with cognitive ability. This would limit the incremental predictive value of the Teamwork KSA. In addition, this could lead to potential issues, such as adverse impact if the measure is used in a selection process. Thus, Littlepage et al. (2015) developed Teamwork Situational Judgment Test (Teamwork SJT), a new measure of teamwork knowledge, skills, and abilities. The Teamwork SJT was less contaminated by cognitive ability than the Teamwork KSA (Steffensen, 2014).

The primary goal of this study was to examine the impact of having teamwork knowledge, skills, and abilities on overall teamwork behavior, using the Teamwork SJT scale. This relationship was examined for the most critical team member (core role) as well as across all team members. This is because, each team member might hold different roles from other team members, based on the level of criticality in terms of team

effectiveness. Core member's KSAs might contribute the most to enabling effective teamwork behaviors.

In general, having teamwork KSA did not impact individual teamwork behavior or overall teamwork. The study results did not support the hypothesized positive relation between teamwork knowledge, skills, and abilities and teamwork behavior. At the individual level, individual's Teamwork SJT scores were not related to scores on teamwork behavior measures (CATME-B and Individual Performance Measure).

When examining scores on Teamwork SJT scores and teamwork behavior measures for core role holders, core member's Teamwork SJT scores were positively related to Individual Performance Measure scores. Core member's Teamwork SJT scores did not show any meaningful relationship with CATME-B scores. Therefore, for the core members, having teamwork KSA influenced their teamwork behavior, but only if an observer rated the core member's performance. This relationship was not supported when team members evaluated the core member's performance. One possible reason is CATME-B has the ceiling effect as revealed by the high mean and low standard deviation. In addition, two thirds of the variance in CATME-B scores was at team level according to the results of multilevel analysis. This means much of the variance was not distinguished at the individual level. This may have led to imprecise evaluation of core member's teamwork behavior, when CATME-B was used as a measure of teamwork behavior.

At the team level, the average of team members' Teamwork SJT scores was not positively related to any of the scores on the team's teamwork behavior measures

(CATME-B, Individual Performance Measure, Transition Teamwork, and Teamwork Questionnaire). Especially surprising, team's Teamwork SJT scores were negatively related to its members' Teamwork Questionnaire scores. In other words, when team members had better knowledge on teamwork, teams tended to acquire lower average rating on team process from their members. It could be that when teams are more knowledgeable about teamwork, they can more clearly identify teamwork deficiencies and are more critical of their team. Lastly, the results did not support a positively relationship between a core member's Teamwork SJT score and his or her team's scores on the measures of teamwork behavior.

Teamwork knowledge, skills, and abilities of core-role holder seems to affect his or her teamwork behavior, but it does not appear to have measurable effects on overall teamwork. One possible reason for this is personality of individual team members. By the nature of the FOCUS Lab, students are assigned into teams at the beginning of each semester, without having any pre-test. During this process, various types of personality may not be evenly distributed. If a smart, but introverted individual was assigned to FOC, and the rest of members possessed an outgoing disposition, the core member might have had a hard time managing the team. The FOCUS Lab staff have seen cases that a team member with outgoing personality, but in a peripheral role, was leading the team, while the team's FOC was struggling. Therefore, personality might have played a role between teamwork KSA and teamwork behavior.

Implications of the Results

The findings from this study indicated that, in general, Teamwork SJT scores were not related to those of teamwork behavior measures. There was little support, if any, for criterion validity of Teamwork SJT. The only significant correlation supported by the results of this study was the relationship between Teamwork SJT scores of core role holders and their Individual Performance Measure scores. This implies that teamwork knowledge, skills, and abilities may be more critical for core members than for other team members. That being so, when composing a team, at least a core member's level of teamwork knowledge, skills, and abilities may need to be examined for higher effectiveness of the team.

Limitation and Future Research

Despite the findings of this study, there are some noteworthy limitations. First, it appeared to be that there was a lack of individual variance in CATME-B scores. On the 5-point scale, the average score was 4.33 with standard deviation of 0.44. The score was negatively skewed, meaning most scores were distributed close to the higher end of the scale. Thus, there seems to be the ceiling effect in CATME-B scores.

Second, there was only one observer per team member when the FOCUS Lab staff were rating team performance; so, there was no way to establish inter-rater reliability in this study. Another limitation is that each position within a team was rated by different observers. The observers were all subject matter experts, so the quality of ratings would not be in question, but they may have varied in their interpretation of Likert

Scale anchors. In order to increase consistency, having two or more observers rating all positions within a team would be helpful.

Third, a participant's academic specialization might have limited the true investigation of the relationship between teamwork KSA and teamwork behavior. Students had different concentrations in Aerospace, such as Aviation Management, Flight Dispatch, Maintenance Management, and Unmanned Aircraft Systems (UAS) Operations, and their previous education might have affected some of the teamwork process. Thus, the relationship between team member role and academic concentration in Aerospace might affect the relationship between teamwork KSA and teamwork behavior.

Lastly, students in the FOCUS Lab are required to complete approximately 45 different measures throughout a semester. While some of the measures are very brief, having less than 5 items, others are long, between 30 and 60 items, and it takes a significant amount of time to finish those measures. Therefore, there is a chance that participants experienced measurement overload.

Future study should seek to include moderators in a hypothesis. As discussed above, personality and academic specialization of participants might affect the magnitude or direction of the relationship between teamwork KSA and teamwork behavior. Previous research has shown that teamwork knowledge was positively related to team performance (McClough & Rogelberg, 2003). The relationship was not supported in this study, and personality and academic specialization are reasonable explanations to take into consideration.

A further consideration would be to examine these hypotheses using a different measure of teamwork knowledge, skills, and abilities that is more specifically tailored to the FOCUS Lab roles. The use of generic Teamwork SJT regardless of individual's position might be another possible reason to explain why the hypotheses in this study were not supported, because Teamwork SJT scores were used to test all of the hypotheses.

Conclusion

Based on previous research on teamwork knowledge, it was hypothesized that teamwork knowledge (and skills and abilities) would be positively related to teamwork behavior, using Teamwork SJT and different types of teamwork behavior measures. Further, it was expected that core member's knowledge on teamwork process would have a significant impact on teamwork behavior. There was mixed evidence about the relationship between teamwork knowledge and teamwork behavior of the core member. However, in general, Teamwork SJT scores were not related to scores on the measure of teamwork behavior. Despite good construct validity, Teamwork SJT should not be used for selection unless criterion validity can be established, because no evidence for criterion validity was found in this study.

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APPENDICES

APPENDIX A: IRB Approval Letter

IRB
INSTITUTIONAL REVIEW BOARD
 Office of Research Compliance,
 010A Sam Ingram Building,
 2269 Middle Tennessee Blvd
 Murfreesboro, TN 37129

**IRBN007 – EXEMPTION DETERMINATION NOTICE**

Thursday, April 25, 2019

Principal Investigator **Jeeun Yi** (Student)
 Faculty Advisor Glenn Littlepage
 Co-Investigators Michael Hein
 Investigator Email(s) *jy2v@mtmail.mtsu.edu; glenn.littlepage@mtsu.edu*
 Department Psychology

Protocol Title ***Do team members need to know how to function as a team? The relationship between teamwork knowledge and teamwork behavior***

Protocol ID **19-1237**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXEMPT** review mechanism under 45 CFR 46.101(b)(2) within the research category (4) *Study involving existing data*. A summary of the IRB action and other particulars in regard to this protocol application is tabulated as shown below:

IRB Action	EXEMPT from further IRB review***	Date	4/25/19
Date of Expiration	NOT APPLICABLE		
Sample Size	500 (FIVE HUNDRED)		
Participant Pool	Data previously collected from Healthy Adults (18 or older)		
Exceptions	NONE		
Mandatory Restrictions	<ol style="list-style-type: none"> 1. Participants must be 18 years or older 2. Informed consent must be obtained from the participants 3. Identifying information must not be collected 		
Restrictions	<ol style="list-style-type: none"> 1. All restrictions for exemption apply. 2. Not approved for new data collection: analysis of data collected during the capstone aerospace class (Aerospace 4040) 3. Prohibited from collecting or analyzing audio/video data. 		
Comments	NONE		

***This exemption determination only allows above defined protocol from further IRB review such as continuing review. However, the following post-approval requirements still apply:

- Addition/removal of subject population should not be implemented without IRB approval
- Change in investigators must be notified and approved
- Modifications to procedures must be clearly articulated in an addendum request and the proposed changes must not be incorporated without an approval

- Be advised that the proposed change must comply within the requirements for exemption
- Changes to the research location must be approved – appropriate permission letter(s) from external institutions must accompany the addendum request form
- Changes to funding source must be notified via email (irb_submissions@mtsu.edu)
- The exemption does not expire as long as the protocol is in good standing
- Project completion must be reported via email (irb_submissions@mtsu.edu)
- Research-related injuries to the participants and other events must be reported within 48 hours of such events to compliance@mtsu.edu

Post-approval Protocol Amendments:

The current MTSU IRB policies allow the investigators to make the following types of changes to this protocol without the need to report to the Office of Compliance, as long as the proposed changes do not result in the cancellation of the protocols eligibility for exemption:

- Editorial and minor administrative revisions to the consent form or other study documents
- Increasing/decreasing the participant size

Only THREE procedural amendment requests will be entertained per year. This amendment restriction does not apply to minor changes such as language usage and addition/removal of research personnel.

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

The investigator(s) indicated in this notification should read and abide by all applicable post-approval conditions imposed with this approval. [Refer to the post-approval guidelines posted in the MTSU IRB's website.](#) Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident.

All of the research-related records, which include signed consent forms, current & past investigator information, training certificates, survey instruments and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study completion. Subsequently, the researcher may destroy the data in a manner that maintains confidentiality and anonymity. IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University

Quick Links:

[Click here](#) for a detailed list of the post-approval responsibilities.
More information on exmpt procedures can be found [here](#).

APPENDIX B: Teamwork Situational Judgment Test

Part 1: Teamwork Situational Judgment Test Scale

Instructions:

You will be presented with 10 scenarios related to team functioning. For each scenario, there are various actions you might take. Review each scenario and use the following scale to rate **your** likelihood of taking each of the possible actions. Please rate **each** response choice on how likely **you** would be to take the actions.

Scenario 1

The CEO of a high-end restaurant chain comes into your office and says that she has a disturbing finding. The service quality of waiters and waitress (servers) is at a two year low, and customers that usually go to your restaurant are going to other places to eat instead. As the Vice President of Human Resources, you are tasked with analyzing the situation and coming up with a solution to improve the server performance. You have decided that the first step to tackle the problem is to create a team of individuals from corporate Human Resources and local managers in the organization that may be useful in solving this issue. Right after forming the team, you are trying to decide what should be your next immediate step in trying to solve this problem.

Please rate **each** response choice on how likely **you** would be to take the action(s):

1. Have a team meeting to discuss possible nature of the problem and potential steps that can be taken to improve server performance.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Have your team research industry trends to see if they can find any useful information that could be used to identify common problems with server performance.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Immediately start to work on the task, leaving everyone to figure out how to accomplish the CEO's goal for themselves.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Have your team call managers in various restaurant locations to find out if they understand the nature of the problems in server performance.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Have a meeting with your team discuss relevant tasks, challenges, and resources needed to analyze the problem.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Fire your old service staff and put your team in charge of hiring new service staff.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 2

You are on a team that has goals set to meet specific organizational standards. You have noticed that deadlines for team tasks are not being met. It has come to your attention that the goals being set are too general and members are becoming unsure of the standards they should meet. The timelines for meeting goals are too vague, which has resulted in lack of consensus among group members of which goals should be prioritized. The group's productivity is declining.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Exclude the goals that are set by the organization and focus on prioritizing group goals.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Suggest to the group that fewer goals should be set.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Consult with the group for more specific and attainable goals.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Criticize group members for the goals not being met.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Take responsibility for establishing new individual goals for other team members.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Suggest to the group that new timelines should be set to clarify which tasks are to be prioritized.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 3

You are a part of a team that has been working on a project for six months. It has become apparent to the team that the original strategy set for completing the project is not working out. The team is unsure of how to proceed.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Suggest that a new strategy should be created and implemented in order to better complete the team's task.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Continue with the current strategy but try to fix areas of the plan that need improving.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Use the experience to highlight the importance of having alternative strategies for when problems arise.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Criticize the current strategy and the lack of group productivity on the team task.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Develop an alternative strategy for the team and present it at the next meeting for discussion.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. In front of the team's external supervision, place the responsibility of the failed strategy on the other team members.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 4

You work for a home construction team that was recently subcontracted to develop the frame for a two-story home. The framing contract has a firm timeline of three weeks because a roofing team from another construction company has been subcontracted to begin roofing detail the day after your timeline closes. Your team developed a three-week outline with established goals for frame development. One week from the deadline, the lumber company delivering your last shipment of wood tells you that the shipment is going to be two to three days late. Seeking out an alternative wood provider would take longer than the two to three day delay.

Please rate **each** response choice on how likely **you** would be to take the action(s):

1. Discuss the delivery delay with one or two team members without notifying the contractor, complete a minor amount of work with the available supplies, and allow team members to rest until the new delivery day even if achievable goals are not yet complete.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Identify the exact percentage of completed framing through team member meetings, communicate production progress and sub-goal completion to your team and the contractor, and redevelop goals into a compressed timeline.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Notify the contractor and your team members that a delivery delay has temporarily stalled production and demand that the contractor extend the deadline so your team can establish new goals for the project.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. With the help of team members, estimate how much framing has been completed and the amount of time that will be required to complete the project after the delay and request a deadline extension from the contractor based on your team's estimations.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Accept the fact that the delivery will be delayed and that the deadline cannot be reached, completely stall production without notifying the contractor, and give team members two days off until the supplies arrive.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Complete the goals that were established until the point of the delivery delay and hope that the delivery will actually arrive earlier than the 2 to 3 day delay.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 5

You are the resource and systems monitor to the logistics team at *We Deliver Packages, Inc.* that is in charge of making sure *WDP* delivery trucks have the resources and information they need to make their deliveries on time in the greater metropolitan area of one major city in the USA. During the middle of the night, a storm hit your metropolitan area. As a result, major roadways are closed and electricity is out around town, which makes refueling of your delivery trucks a problem. You need to collect information about your team's delivery system and resources and provide the relevant information to each driver so that he or she can deliver all of the packages today.

Please rate **each** response choice on how likely **you** would be to take the action(s):

1. Tell your drivers about major road closings and to keep an eye out for working gas stations.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Tell your drivers about major road closings and to radio in when they are low on gas to find out where working gas stations are located.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Tell your drivers to do the best they can and to return to base when they are low on gas.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Tell your drivers about the road closings, detours and working gas stations on their routes.

- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---------------|----------|-------------------|----------------------------|-----------------|--------|-------------|
| | Very Unlikely | Unlikely | Somewhat Unlikely | Neither Likely or Unlikely | Somewhat Likely | Likely | Very Likely |
5. Tell your drivers to keep an eye out for working gas stations and give them a map of the area.
- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---------------|----------|-------------------|----------------------------|-----------------|--------|-------------|
| | Very Unlikely | Unlikely | Somewhat Unlikely | Neither Likely or Unlikely | Somewhat Likely | Likely | Very Likely |
6. Remove some of today's deliveries from the trucks so the drivers will not need to refuel.
- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---------------|----------|-------------------|----------------------------|-----------------|--------|-------------|
| | Very Unlikely | Unlikely | Somewhat Unlikely | Neither Likely or Unlikely | Somewhat Likely | Likely | Very Likely |

Scenario 6

You are in a team with several team members that report to a team leader. The assigned proposal requires team members to work interdependently with common knowledge. The due date of the proposal is in 3 days and one of your team members in the same office is away on sick leave. Reading through the proposal, you notice that your team member's assigned section is in such disarray that it is difficult to understand and follow.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Assume the team leader probably has it all under control and will deal with the situation soon.
- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---------------|----------|-------------------|----------------------------|-----------------|--------|-------------|
| | Very Unlikely | Unlikely | Somewhat Unlikely | Neither Likely or Unlikely | Somewhat Likely | Likely | Very Likely |
2. Inform the team leader that attention is needed for the sick team member's section and offer your assistance.
- | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---------------|----------|-------------------|----------------------------|-----------------|--------|-------------|
| | Very Unlikely | Unlikely | Somewhat Unlikely | Neither Likely or Unlikely | Somewhat Likely | Likely | Very Likely |
3. Finish your own assigned section first and then decide whether or not to tell the other team members about the situation of the sick member's section.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Report the situation to the team leader and ask whether you can spare some time to improve your sick team member's section.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Inform your sick team member immediately that his/her assigned section requires attention.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Consult with other team members immediately and let them decide what to do.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 7

You are the leader of a team that has been assigned various complex tasks that *must* be completed in a very short time period. These tasks require that the team work together interdependently to accomplish them successfully. Your team members all have very different schedules. That makes it difficult to coordinate one specific meeting time for all members, and also makes it difficult to compile each person's work efforts into one product. As the team leader, it is your responsibility to make sure the overall tasks is completed successfully in a timely manner.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. See about pushing the deadline back until all members are able to meet together to complete the tasks.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Thoroughly examine all members' individual schedules and set a weekly meeting time that works for everyone, even if the time is not ideal (i.e. late nights/weekends).

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Decide as the team leader how the tasks can be split up and assign each team member a specific task to complete on their own. Then, have one meeting where all completed individual work will be compiled into one cohesive product.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Convince the team members to ignore their other obligations at this time in order to meet this deadline.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Accept that the tasks cannot be done in the time allotted and step down as team leader.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Add more members to the team in hopes that their schedules will coordinate better.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 8

Currently you are a member of a team and your team has been assigned a new project to complete. During the initial team meeting to discuss the project and its details you notice that conflict is arising between the team members. The team met to discuss roles during the project and to assign tasks to each individual. There is conflict among the team members over who will be responsible for each part of the project. The team has a very tight deadline and cannot afford to waste any time.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Try to identify each team member's strengths and weaknesses and match tasks according to individual strengths.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Go to your supervisor and explain the situation in hopes that he or she will be able to resolve the problem.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Suggest that tasks be randomly assigned to each team member so the project can move forward.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Ask the group leader to assign roles to each individual based on whom they believe will do the best job.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Ask the group leader to assign roles without any input from others.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Propose that everyone identify which tasks they would like and have them provide an explanation as to why they feel they would be the best one for this task.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 9

You are part of a team and you have an important project that needs to be completed in three months. Your team has been working well for the past month. Recently, you have come to notice that some of your team members have started to slow the pace of their work and are not working on the project as much as they had been previously. Also, you have found that a few of your team members do not interact much with the team. If these circumstances continue, it will be impossible for your team to complete the project in the next two months.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Inform the team there will be a party after the successful completion of the project.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Propose that the manager reward the team member who shows the best performance on the project.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Inspire your team members by telling them that it is their collective responsibility to complete the project by the due date, and that the successful completion of this important project depends on each of their efforts.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Remind the team members about their past successes and how hard they have worked towards achieving the team's goals.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Hold a team meeting and focus on the lack of work that has been completed so far.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Remove all the assigned deadlines for each of the team member's work.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Scenario 10

You are the leader of a team that has been working on a project for several months now. The project is almost finished, but there is still a lot of work to be completed and the deadline is quickly approaching. While the team members have consistently worked well together throughout the duration of the project, the urgency of the project's deadline is causing stress among members. You sense that tension is rising among your members as the deadline approaches and you believe this may lead to the project not getting finished on time.

Please rate *each* response choice on how likely *you* would be to take the action(s):

1. Suggest to your team to use the stress they are experiencing as a motivator and to keep pushing forward until the project is complete.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

2. Plan a celebration upon completion of the project that team members can look forward to, while reminding them that success depends on all of their combined efforts.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

3. Stress the importance of the approaching deadline to your members, and remind them that there is not time for conflict or for anyone to get emotional.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

4. Realizing the urgency of the deadline, require team members to work longer hours and turn in a daily progress report of the work they have completed.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

5. Ignore the tension between team members and hope it does not escalate.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

6. Encourage team members to maintain positive attitudes and to not let the pressure cause conflict amongst themselves.

1	2	3	4	5	6	7
Very Unlikely	Unlikely	Somewhat Unlikely	Neither Likely or Unlikely	Somewhat Likely	Likely	Very Likely

Part 2: Scoring Guide for Teamwork Situational Judgment Test

Scenario 1: Mission Analysis

$$\text{Item 1} + \text{Item 5} - \text{Item 3} - \text{Item 6} = \text{Total}$$

Scenario 2: Goal Specification

$$\text{Item 3} + \text{Item 6} - \text{Item 1} - \text{Item 4} = \text{Total}$$

Scenario 3: Mission Analysis

$$\text{Item 1} + \text{Item 5} - \text{Item 4} - \text{Item 6} = \text{Total}$$

Scenario 4: Mission Analysis

$$\text{Item 2} + \text{Item 4} - \text{Item 1} - \text{Item 5} = \text{Total}$$

Scenario 5: Mission Analysis

$$\text{Item 2} + \text{Item 4} - \text{Item 3} - \text{Item 6} = \text{Total}$$

Scenario 6: Mission Analysis

$$\text{Item 2} + \text{Item 4} - \text{Item 1} - \text{Item 3} = \text{Total}$$

Scenario 7: Mission Analysis

$$\text{Item 2} + \text{Item 3} - \text{Item 4} - \text{Item 5} = \text{Total}$$

Scenario 8: Mission Analysis

$$\text{Item 1} + \text{Item 6} - \text{Item 3} - \text{Item 5} = \text{Total}$$

Scenario 9: Mission Analysis

$$\text{Item 3} + \text{Item 4} - \text{Item 2} - \text{Item 6} = \text{Total}$$

Scenario 10: Mission Analysis

$$\text{Item 2} + \text{Item 6} - \text{Item 4} - \text{Item 5} = \text{Total}$$

Sum of Totals = Composite Score

APPENDIX C: Comprehensive Assessment of Team Member Effectiveness (CATME-B)

1. Rate each team member on their contributions to *the team's work*.

Below are three statements describing excellent, three describing average, and three describing below average work. Rate each position by selecting one of the circles in the ROW corresponding to the level of performance of the person in that position. **For the position you held, keep the line blank.**

	<u>Excellent</u>	Demonstrates behaviors described immediately left and right.	<u>Average</u>	Demonstrates behaviors described immediately left and right.	<u>Below Average</u>
	<ul style="list-style-type: none"> -Does more or higher-quality work than expected -Makes important contributions that improve the team's work. -Helps teammates who are having difficulty completing their work. 		<ul style="list-style-type: none"> -Completes a fair share of the team's work with acceptable quality. -Keeps commitments and completes assignments on time. -Helps teammates who are having difficulty when it is easy or important. 		<ul style="list-style-type: none"> -Does not do a fair share of the team's work. Delivers sloppy or incomplete work. -Misses deadlines. Is late, unprepared, or absent for team meetings. -Does not assist teammates. Quits if the work becomes difficult.
Flight Operations Coordinator					
Flight Operations Data 1 (Scheduling)					
Flight Operations Data 2 (Planning)					
Crew Scheduling					
Weather & Forecasting					

Maintenance Control					
Ramp Tower					
Pilots (Pseudo and CRJ)					

2. Rate each team member on their contributions to **teammate interaction**.

Below are four statements describing excellent, four describing average, and four describing below average teammate interaction. Rate each position by selecting one of the circles in the ROW corresponding to the level of performance of the person in that position. **For the position you held, keep the line blank.**

	<u>Excellent</u>	Demonstrates behaviors described immediately left and right.	<u>Average</u>	Demonstrates behaviors described immediately left and right.	<u>Below Average</u>
	<ul style="list-style-type: none"> -Asks for and shows an interest in teammates' ideas and contributions. -Makes sure teammates stay informed and understand each other. -Provides encouragement or enthusiasm to the team. -Asks teammates for feedback and uses their suggestions to improve. 		<ul style="list-style-type: none"> -Listens to teammates and respects their contributions. - Communicates clearly. Shares information with teammates. -Participates fully in team activities. -Respects and responds to feedback from teammates. 		<ul style="list-style-type: none"> -Interrupts, ignores, bosses, or makes fun of teammates. -Takes actions that affect teammates without their input. Does not share information -Complains, makes excuses, or does not interact with teammates. -Is defensive. Will not accept help or advice from teammates.
Flight Operations Coordinator					

Flight Operations Data 1 (Scheduling)					
Flight Operations Data 2 (Planning)					
Crew Scheduling					
Weather & Forecasting					
Maintenance Control					
Ramp Tower					
Pilots (Pseudo and CRJ)					

5. Rate each team member on their **possession of related knowledge, skills, and abilities**.

Below are three statements describing excellent, three describing average, and three describing below average possession of related knowledge, skills, and abilities. Rate each position by selecting one of the circles in the ROW corresponding to the level of performance of the person in that position. **For the position you held, keep the line blank.**

	<u>Excellent</u>		<u>Average</u>		<u>Below Average</u>
	<ul style="list-style-type: none"> - Demonstrates the knowledge, skills, and abilities to do excellent work. -Acquires new knowledge or skills to improve the team's performance. -Able to perform the role of any team member if necessary. 	Demonstrates behaviors described immediately left and right.	<ul style="list-style-type: none"> - Demonstrates sufficient knowledge, skills, and abilities to contribute to the team's work. -Acquires knowledge or skills as needed to meet requirements. -Able to perform some of the tasks normally done by other 	Demonstrates behaviors described immediately left and right.	<ul style="list-style-type: none"> -Missing basic qualifications needed to be a member of the team. -Unable or unwilling to develop knowledge or skills to contribute to the team. -Unable to perform any of the duties of other team members.

			team members.		
Flight Operations Coordinator					
Flight Operations Data 1 (Scheduling)					
Flight Operations Data 2 (Planning)					
Crew Scheduling					
Weather & Forecasting					
Maintenance Control					
Ramp Tower					
Pilots (Pseudo and CRJ)					

APPENDIX D: Individual Performance Measure

Individual Performance Measure - Flight Operations Coordinator (FOC)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>		<i>Sometimes</i>			<i>Always</i>	
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Performs dispatch duties in a timely manner.
2. _____ Makes effective decisions to resolve unusual events.
3. _____ Multitasks and makes assertive decisions under time-stress situations.
4. _____ Most often anticipates flight delays and cancellations.
5. _____ Employs proactive strategies to remedy the situation/event that takes place during the simulation.
6. _____ Remains cognizant of all ongoing issues that take place during the simulation.
7. _____ Operates in accordance to FAA Regulations (e.g., does not violate tarmac rule, does not release a flight to a destination where the flight is not capable to land).
8. _____ **Information Flow:** Shares relevant information as needed with other team members.
9. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
10. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

Individual Performance Measure - Weather & Forecasting (WX)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Identifies weather conditions that will impact a flight prior to departure, *en route*, or upon arrival (e.g., cross winds).
2. _____ Notifies relevant team members of weather conditions that may impact a flight or the flight schedule (e.g., headwinds, NOTAMs, destination alternates, and icing conditions).
3. _____ Advises team on weather conditions using quality information (i.e., is specific and effective and uses appropriate terminology).
4. _____ Recommends a safe route for flights after considering all information on weather conditions.
5. _____ Recommends a viable destination alternate to the team when required.
6. _____ Violates airline operating procedures and/or general FAA regulations (e.g., the 1-2-3 rule, take-off visibility minimums, lands on wet runway with tail winds greater than 5 knots, etc.) (*R)
7. _____ Causes unnecessary delays because of a failure to clear flights in a timely manner. (*R)
8. _____ **Information Flow:** Shares relevant information as needed with other team members.
9. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
10. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

Individual Performance Measure - Crew Scheduling (CS)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Effectively keeps track of crews' duty times.
2. _____ Incorporates all the flight delays/cancellations into crew's duty times.
3. _____ Incorporates calls in to an optimal reserve crew in a timely fashion.
4. _____ Is able to multitask and work well under time-stress situations, prioritizing his/her work in accordance to the event/scenarios that take place during the simulation.
5. _____ Ensures that crews are not scheduled for flights that will result in busted times (e.g., dead heading reserve crews when appropriate, rotating crews).
6. ITEM REMOVED – Operates in accordance with FAA regulations (see item 5).
7. _____ **Information Flow:** Shares relevant information as needed with other team members.
8. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
9. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

Individual Performance Measure - Flight Ops Data 2 (Flight Planning)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Enters the appropriate information into the Spreadsheet.
2. _____ Determines weight and balance information in a timely fashion.
3. _____ Accurately determines fuel, weight and balance information.
4. _____ Effectively bumps passengers and cargo as needed.
5. _____ When necessary, quickly and efficiently reroutes bumped passenger & cargo.
6. _____ Operates in accordance to FAA Regulations (e.g., does not allow flights to take off and/or land overweight/overbooked, always ensures a proper fuel load for flights).
7. _____ **Information Flow:** Shares relevant information as needed with other team members.
8. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
9. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

Individual Performance Measure - Flight Ops Data 1 (Flight Scheduling)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Accurately timestamps all of the released flights immediately after the flights were released by the FOC.
2. _____ Accurately timestamps all of the arrival flights immediately after the radar indicated flight was in approach.
3. _____ Effectively indicates special status of flights on schedule display (e.g., delays, maintenance, emergencies, etc.).
4. _____ Maintains visual organization of the radar screen (i.e., screen is readable with no difficult-to-read data and no overlapping).
5. ITEM REMOVED – Operates in accordance with FAA regulations.
6. _____ **Information Flow:** Shares relevant information as needed with other team members.
7. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
8. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)
9. _____ Maintains flight schedule, updating the status of flights as issues are resolved.
10. _____ Assists the FOC in staying on schedule.

Individual Performance Measure – Maintenance Control (MX)

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>

1. _____ Resolves all the maintenance issues in the most effective way.
2. _____ Accurately estimates delay time for repairs.
3. _____ Effectively document repairs to an aircraft while using the RMS and the MEL.
4. _____ Effectively handles all the scheduled repairs while dealing with unexpected issues.
5. _____ Prioritizes work as needed.
6. _____ Operates in accordance to FAA regulations (e.g., does not properly follow all procedures outlined in the Minimum Equipment List for each applicable inoperative item).
7. _____ **Information Flow:** Shares relevant information as needed with other team members.
8. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
9. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

Individual Performance Measure – Hub Coordinator

Team _____ Semester _____ SIM (Circle) 1 2 3 Date of SIM _____
 Rater _____

On a scale of 1 to 7, where 1 is never and 7 is always, please rate each task in way that would best represent individual's behavior throughout the entire flight simulation.

<i>Never</i>			<i>Sometimes</i>			<i>Always</i>	
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	

1. _____ Effectively identifies flights departing for a hub location that will be delayed more than 40 minutes.
2. _____ Reroutes leftover passengers and cargo in an efficient manner.
3. _____ Efficiently reroutes bumped and/or delayed passengers and cargo (i.e., uses Universal E-Lines flights when possible).
4. _____ Leaves passengers or crews unnecessarily stranded.
5. _____ Is resourceful in helping the team deal with passenger, crew, and cargo issues.
6. _____ **Information Flow:** Shares relevant information as needed with other team members.
7. _____ **Information Utilization:** When appropriate, actively solicits information from key team members in order to arrive to best quality decisions.
8. _____ **Coordination:** Coordination with other team members is effective. (Proper phraseology/Efficient communication channels are always used.)

APPENDIX E: Transition Teamwork & Transition Performance

Observer-rated Transition Teamwork

Observer-rated Transition Teamwork

Please use the following scale to describe the extent to which the team did the following during the simulation.

To what extent did the team actively work to

1	2	3	4	5
Not at all	Very Little	To Some Extent	To a Great Deal	To a Very Great Extent

- _____ 1. Mission Analysis (e.g. identify main tasks, challenges, & resource needs)
- _____ 2. Goal Specification (e.g. set team goals, ensure understanding, link to strategy)
- _____ 3. Strategy Formulation and Planning (e.g. develop strategy, contingency planning, knowing when to stick with or modify plan)
- _____ 4. Contribute information during the After Action Review that would help improve team performance?
- _____ 5. Ensure that information learned during the After Action Review will be used to improve team performance?

Transition Performance (Facilitator)

Observer-rated After-Action Review Planning

Please use the following scale to describe the extent to which the team did the following during the simulation.

To what extent did the team actively work to

1	2	3	4	5
Not at all	Very Little	To Some Extent	To a Great Deal	To a Very Great Extent

Mission Analysis

- _____ 1. Identify the main tasks?
- _____ 2. Identify the key challenges that were expected?
- _____ 3. Determine the resources that were need to be successful?

Goal Specification

- _____ 4. Set goals for the team?
- _____ 5. Ensure that everyone on the team clearly understood the goals?
- _____ 6. Link goals with the strategic direction of the organization?

Strategy Formulation and Planning

- _____ 7. Develop an overall strategy to guide the team activities?
- _____ 8. Prepare contingency (“if-then”) plans to deal with uncertain situations?
- _____ 9. Know when to stick with a given working plan, and when to adopt a different one?

- _____ 10. Contribute information during the After Action Review that would help improve team performance?

- _____ 11. Ensure that information learned during the After Action Review will be used to improve team performance?

APPENDIX F: Teamwork Questionnaire

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Please use the following scale to describe your team that just completed the NASA lab simulation exercise.

To what extent does our team actively work to

1	2	3	4	5
Not at all	Very Little	To Some Extent	To a Great Deal	To a Very Great Extent

Mission Analysis

- _____ 1. Identify our main tasks?
 _____ 2. Identify the key challenges that we expect to face?
 _____ 3. Determine the resources that we need to be successful?

Goal Specification

- _____ 4. Set goals for the team?
 _____ 5. Ensure that everyone on our team clearly understands our goals?
 _____ 6. Link our goals with the strategic direction of the organization?

Strategy Formulation and Planning

- _____ 7. Develop an overall strategy to guide our team activities?
 _____ 8. Prepare contingency (“if-then”) plans to deal with uncertain situations?
 _____ 9. Know when to stick with a given working plan, and when to adopt a different one?

Monitoring Progress toward Goals

- _____ 10 Regularly monitor how well we are meeting our team goals?
 _____ 11. Use clearly defined metrics to assess our progress?
 _____ 12. Seek timely feedback from stakeholders (e.g., customers, top management, other organizational units) about how well we are meeting our goals?

Resource and Systems Monitoring

- _____ 13. Monitor and manage our resources (e.g., financial, equipment, etc.)?
 _____ 14. Monitor important aspects of our work environment (e.g., inventories, equipment and process operations, information flows)?
 _____ 15. Monitor events and conditions outside the team that influence our operations?

Team Monitoring and Backup

- _____ 16. Develop standards for acceptable team member performance?

- _____ 17. Balance the workload among our team members?
- _____ 18. Assist each other when help is needed?

Coordination

- _____ 19. Communicate well with each other?
- _____ 20. Smoothly integrate our work efforts?
- _____ 21. Coordinate our activities with one another?

Conflict Management

- _____ 22. Deal with personal conflicts in fair and equitable ways?
- _____ 23. Show respect for one another?
- _____ 24. Maintain group harmony?

Motivating and Confidence Building

- _____ 25. Take pride in our accomplishments?
- _____ 26. Develop confidence in our team's ability to perform well?
- _____ 27. Encourage each other to perform our very best?

Affect Management

- _____ 28. Share a sense of togetherness and cohesion?
- _____ 29. Manage stress?
- _____ 30. Keep a good emotional balance in the team?