ARE YOU REALLY THE CENTER OF OUR SUCCESS? THE EFFECT OF CORE ROLES ON THE RELATIONSHIP BETWEEN INDIVIDUAL PERFORMANCE AND TEAM PERFORMANCE

by

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ABSTRACT

The relationship between individual performance and team performance is examined. The study utilized teams participating in a series of high-fidelity simulations of airline operations. Hypotheses were investigated relating to the impact of both taskwork and teamwork behaviors (LePine, 2005) and the impact of persons in core and peripheral roles (Humphrey, Morgeson, & Mannor, 2009). Effects on both routine and non-routine or adaptive performance were investigated. Both individual taskwork and teamwork behaviors were related to team performance. Both team member role and type of task (routine vs. adaptive) moderated these relationships. Relations between individual and task performance was higher for adaptive than routine tasks and for persons in core roles than for persons in peripheral roles. Findings extend existing theories of core roles and team adaptation.

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CHAPTER ONE: INTRODUCTION

As time continues to pass and organizations continue to grow, the presence of groups and teams among organizations is also becoming more prominent as well (Cohen & Bailey, 1997). Work teams within organizations can be thought of as groups of individuals who share the primary purpose of working together to solve or achieve a common goal, interacting with one another socially, and completing interdependent tasks (Mathieu, Maynard, Rapp & Gilson, 2008). The increased need for teams among organizations could be due, in part, to a number of factors including the fact that the level of complexity that technology has introduced among the workplace (Urban, 1995), or it could just be due to the fact that organizational leaders are realizing the benefits of employing teams (Mathieu, Tannenbaum & Alliger, 2013).

There are many benefits to using teams, and the literature presents one of those benefits as being the fact that teams allow organizations to stay competitive in the organizational arena (LePine, 2003). Further to this point, LePine (2013) also suggests that teams are an advantageous addition to the organizational arena because they increase the flexibility in organizations. Using teams has also proven to bring more resources, and more diverse resources at that, on tasks than individual members can bring (Hackman, 1998). Hackman (1998) also commented that "teams composed of people from different units can transcend traditional functional and organizational barriers and get members pulling together toward collective objectives" (p. 246). Furthermore, teams provide the opportunity for the development of synergy that allows them to get together and accomplish something that team members could not do alone (Hackman, 1998). These demonstrate just a few of the benefits of utilizing teams among organizations, and many

organizations are making sure that they are taking advantage of them. It is said, by Paul Osterman, economist at MIT, that in the manufacturing field alone more than half of the companies use teams (Hackman, 1998). Furthermore, Osterman's 1994 research found that of the organizations that he surveyed, about 40% of them revealed that over half of the entire organization worked in teams (as cited in Hackman, 1998). One can image how much that number has grown and spread among various fields in the organizational realm since 1994.

Despite the fact that teams can be effective, it is important to note that the utilization of teams is not a panacea for all organizations. Establishing a team should only be done after certain key factors are considered and important questions are answered. One key aspect that must be attended to is deciding if the task itself even calls for a team. According to Hackman and Katz (2010) it is important to consider the advantages of group (or team) performance versus individual performance before actually making the decision to turn a task into one that requires the combined effort of a team. Furthermore, when deciding who should be on a team, research has suggested that team builders consider how the attributes of individual members will align with those position requirements that will make the team successful (Mathieu et al., 2013). It is very important to pay attention to factors such as these when developing teams as errors in this stage can lead to poor overall team performance (Mathieu et al., 2013).

Team Effectiveness

A team that was properly developed is more likely be effective than a team that was put together haphazardly. In order to understand what it means to have an effective team, however, one must first be able to define team effectiveness. According to Salas,

Stagl, Burke & Goodwin (2007), the idea of team effectiveness is something that has been operationalized in many different ways, but these authors define effectiveness as "a value judgement that is influenced by a number of factors" (p. 196). Another set of researchers regard team effectiveness as the performance outcomes that follow when a group of individuals work together interdependently to successfully accomplish a common goal (Marks, Mathieu, & Zacarro, 2001). Hackman and Katz (2010), however, have also established a definition of team effectiveness that seems to be accepted within the social psychology domain. These researchers define this concept as the ability of a team to achieve its purposes in the domains of actually completing the task, strengthening the group's overall capabilities, and fostering the well-being of each of the individual members of the group (Hackman & Katz, 2010). The first domain of getting the task completed incorporates the team actually being able to accomplish the goal of the team. This focuses on determining if the task was completed and if it was completed adequately (Hackman & Katz, 2010). Hackman, (1987) in his earlier work, mentioned that the product of the teamwork must, at the very least, meet and exceed the standard of the person who assigned the task. The second domain assesses the extent to which the social experiences and processes of the team strengthened their individual belief about being able to work together (Hackman & Katz, 2010). The ability of a team to work together following the completion of a task is a characteristic of an effective team (Hackman, 1987). The final domain assesses the extent to which being a part of a group positively impacts individual members' well-being and learning (Hackman & Katz, 2010). Ultimately, team effectiveness is said to be a joint function of the amount of knowledge and skills each member has, the amount of effort put forth by each member, and how

appropriate the performance strategies are that are implemented by the group (Hackman, 1987).

Team performance can be measured at the team level in a variety of ways, but this is determined by the specific focus of the organization itself. In early research on team performance, it was very common for researchers to focus solely on group dynamics, including concepts such as team cohesion and the overall quality of group interactions. More and more, however, researchers are understanding the importance of trying to actually manage teams as a way to increase performance (Bell, 2007). Some key characteristics that effective teams possess include shared cognition (i.e. mental model), high performance of individual team members, feedback channels, adaptability, and communication (Salas et al., 2007).

Systems theory models are frequently used to describe factors that affect team performance. The model that has been mentioned the most among the research is the Input-Process-Output (I-P-O) model form (Hackman, 1987; Salas et al., 2007). A more encompassing model that has also be presented in research literature is the IMOI Model. The IMOI model, which stands for input-mediator-output-input, compensates for the deficiencies of the I-P-O Model. According to Ilgen, Hollenbeck, Johnson, and Jundt (2005) "substituting the 'M' for 'P' reflects the broader range of variables that are important mediational influences with explanatory power for explaining variability in team performance and viability" (p. 520). This model focuses on the team processes as stages that include variables that influence overall team performance (Ilgen et al., 2005). Some of the emergent states or variables that develop during the life of a team found to influence team performance include trust and shared mental models (Ilgen et al., 2005).

Collective efficacy is an example of another variable present throughout the process of effective teams. The idea of collective efficacy will be addressed further in the following paragraphs. The IMOI model increases the possibility of understanding conditions contributing to team effectiveness because it allows each stage of the teamwork process to be seen. More importantly, it allows not only the relationships between input and output to been studied, but it also presents the opportunity for the mediators that impact that relationship to be studied as well (Ilgen et al., 2005). This idea will be discussed in greater detail later.

There are many factors that can impact the overall effectiveness of a team, but Mohammed, Cannon-Bowers, and Foo (2010) posit that team type and task demand are key determinants of team effectiveness. They suggest that what determines effectiveness differs by the team type and the demand of the task. Both teamwork and taskwork impact overall team effectiveness, but for this study, differentiating between teamwork and taskwork is necessary because this study seeks to examine the impact of each dimension on team performance. In order to assess this relationship, the two concepts must first be parsed out and presented as two distinct constructs. This differentiation between teamwork and taskwork should be one of the factors taken into account when measuring the effectiveness of a team.

Teamwork, as its name suggests, is comprised of the coordination of individual contributions made by all team members. Team performance is directly influenced by teamwork, which comprises “how” team members come together and interact in order to complete the task (Crawford & LePine, 2013). These behaviors will be referred to as individual teamwork in this study. It is important to note that it is not to be confused with

taskwork, which is another factor that is essential to team performance. “Taskwork” refers to the work that is done by each individual member of the team (Crawford & LePine, 2013), and like teamwork can be considered a facet of individual performance. Crawford and Lepine (2013) do emphasize that although these dimensions are different, they are both important for effective group performance. How well an individual performs their specific taskwork and teamwork responsibilities can be evaluated (LePine, et al, 2000). This individual performance can then be further assessed to see exactly how that singular performance impacts the overall team performance success.

Role Composition

Teams are generally comprised of individual members who have been put together to complete a designated task. The fact that teams are established to complete tasks that a single individual cannot perform suggests that there are different roles that need to be filled in order for a team to operate effectively. Traditional methods of establishing teams (such as methods that capitalized on the abilities of individual members) did not take key issues into account, such as the extent to which members were able to work together as a unit. Older methods also failed to emphasize the importance of core roles, but more recent methods seek to take these factors into consideration. The idea that the level of performance of team members can impact the success of the team is the basis for what has come to be known as the “role composition” approach. This approach, more recently developed by Humphrey, Morgeson, and Mannor, (2009) can be defined as a method which “investigates how the characteristics of a set of role holders impact team performance” (p. 48). Mathieu, Maynard, Rapp, and Gilson (2008) describe this role-based performance as one that tends to be more generalizable across different teams. The

decision to build teams based on roles further suggests that there are some roles that are more important to team success than others even though the contributions of the entire team are known to be important for overall team effectiveness (Humphrey, et al., 2009).

In their study focusing on team performance, Bonner, Baumann, and Netchaeva (2016) found that the level of expertise among individual roles has the ability to impact team performance. They found that a certain level of expertise is needed specifically for those persons operating in roles that are critical to the entire group. The nature of the expertise is dependent upon the actual tasks required for team success, however. Expertise is primarily required in domains critical to the entire group. The need for expertise among the various roles embedded in a team further supports the argument that members often have different roles to perform. Moreover, the results that Bonner and colleagues found in their 2016 study also converge with the evidence that suggests that some roles are more important for team success than others.

Role Composition and Teams

Even though much of role composition looks at composing teams based on roles, there have been a few approaches that link the need to focus on the job and the individual when it comes to composition. Bell (2007) mentioned that both researchers and practitioners alike have begun using team composition as a method of managing teams as a technique for increasing performance. According to Mathieu et al. (2013), there are a variety of models team builders use to actually establish teams, a few of which do link the aforementioned ideas. Some of the models include the traditional position fit model, the personnel model, and the team profile model. These models demonstrate the variety of ways in which a team can be established as they all entail focusing on different aspects

on which to base team staffing decisions. According to Mathieu and colleagues (2013), the traditional position fit model is based on the idea that organizations seek to hire the person whose knowledge, skills, and abilities (KSA's) match the position they will occupy best; this method focuses on the position itself. The personnel model, on the other hand, focuses more on the individual. This method examines how the person will fit with the team, not so much how they fit the task (Matheiu, et al., 2013); consequently it is seen to be more team focused than the traditional position fit model. The team profile model "focuses attention at the team level and includes team profile and relative contribution models" (Matheiu, et al., 2013, p. 530). A key aspect of this model is that it looks at KSA's on a team level rather than at the individual level. This model also leaves room for those examining the teams to take the personality profile of the entire team into account.

More and more, priority seems to be given to establishing teams based on core roles. Research suggests that there is a relationship between individual attributes and core roles. For example, the study conducted by Humphrey et al. (2009) found that it was important for members of the team to have certain individual attributes, but more than that, the findings suggested that when dealing with groups, it is more important for persons who hold those core job roles to have those attributes. It is also important to note, that within organizations, it is more important that core roles be filled with star performers among departments that align with the organization's core mission (Aguinis & O'Boyle, 2014). According to Aguinis and O'Boyle (2014), "a star is a relative attribute and their identification is only possible by viewing them in relation to the productivity of others" (p. 315). An example given in their study mentioned that a star performing employee in the housekeeping department of an accounting firm does not do

as much for the bottom line of the organization as a star performing accountant (Aguinis & O'Boyle, 2014). This example demonstrates that when it comes to individual performance, the context of that performance is important to the overall effectiveness of the entire unit. This is something that should be taken into account when establishing teams among various departments of organizations as it supports the idea that some roles are more critical to the overall success of teams.

Establishing a Team: The Role Composition Approach

The idea of role composition suggests that the contributions of individual team members largely impact the team's performance. Research supports the idea that, for the most part, a key component for an effective team is the presence of competent group members (Devine & Philips, 2001; Driskell, et al. 1987). The meta-analysis by Devine and Phillips (2001) indicates that this varies across situation, however. Although task competency is not the only factor that leads to the effectiveness of a team, it is one that can have a large impact.

At a very basic level, team effectiveness can be influenced by the presence, or the absence, of basic teamwork competencies (Mohammed et al., 2010). Mohammed et al. (2010) suggest that basic teamwork competencies include those teamwork behaviors that are common to every person on the team. Examples of some of these competencies include knowledge of teamwork, interpersonal skills, communication skills, and agreeableness (Mohammed et al., 2010). These researchers proposed that because these attributes need to be present among the individual group members, teamwork competencies constitute a factor that can influence overall team performance. Salas et al. (2007) summed up this relationship up by regarding teamwork as a function of both top-

down and bottom-up processes. Top-down focuses on the impact of organizational features such as policies, team culture, and norms. Bottom-up processes focus on performance from the individual that impacts the team at a group level, and includes the function of the behaviors, cognition and, affect of each individual member. The bottom-up relationship is the one that is of most interest in the present study. This relationship is relevant because it ties back into the idea of the role composition approach, which will be discussed in greater detail later. This relationship further demonstrates the fact that individual members of the same team act in different roles and have different responsibilities. An individual's personal attributes (e.g., personality) can influence overall team performance. Research asserts that when a person has high levels of conscientiousness, extraversion, and agreeableness this correlates to increased team performance (Haynie, 2012). This idea was so accepted that for a long time research on teams focused on studying teams that were established based on the individual attributes of potential team members. Personality commonly played a major role in this research, along with individual ability, primarily cognitive ability (Humphrey, 2009). One aspect that this study aims to examine is the idea that the impact of individual performance could also depend on how critical the role itself is to overall team success.

Efficacy and Team Performance

As mentioned earlier, team efficacy is an example of an emergent state, which could potentially impact team performance. Kozlowski & Ilgen (2006) describe it as "a shared belief in a group's collective capability to organize and execute courses of action required to produce given levels of goal attainment" (p. 90). Research suggests that team confidence, of which collective efficacy is a fundamental component, has positive effects

on team performance as it influences what goals are set, effort levels, and perseverance with which team members continue to demonstrate even when they are unable to attain goal (Mathieu et al., 2008). More specifically, collective efficacy and performance are positively correlated. In their meta-analysis, Stajkovic, Lee, and Nyberg. (2009) were able to support this hypothesized correlation across sixty-nine studies including 18,891 participants. At its most basic level, these findings indicate that the greater the amount of collective efficacy among a team, the greater the level of team performance will be. Research has also found that when leaders experience high levels of self-efficacy and have lower levels of anxiety, it can translate into higher collective efficacy for their followers, which then leads to increased group performance (Hoyt et al. 2003; Tasa, Taggar, & Seijts, 2007). This suggests that collective efficacy can be influenced by the self-efficacy of a person in a core job role. These findings further suggest that self-efficacy of the core role holder could potentially act as a moderator in the relationship between individual performance and overall team effectiveness.

Beyond this, however, collective efficacy could also demonstrate the team's ability to recognize that their success is due to their shared competence. This may suggest that each team member recognizes that the competence of persons holding roles that are critical to their overall performance contributes to their success. A study conducted by McIntyre & Foti (2013) found that when a self-directed team has members who recognize that there is a leader, or in this case a person holding a core job role, they tend to have a more accurate and more shared mental model. A potential, and desired, result of this recognition is greater overall performance. This demonstrates that when members of a team all share the common belief that the core role is critical to their overall

performance and act accordingly, team performance is enhanced.

Core Roles

A research study conducted by Humphrey et al. (2009) supports the idea that some roles among teams are more important than others. This study looked at archival data from major league baseball teams, in which the positions of pitcher and catching roles were identified as strategic core roles. Humphrey et al. (2009) defined "the strategic core" as "the role or roles on a team that encounter more of the problems that need to be overcome in the team, have a greater exposure to the task that the team is performing, and are more central to the workflow of the team" (Humphrey, et al., 2009, p. 50). This does not mean that other roles in the team were not important, however. The identified roles just were more closely aligned with the definition presented by the researchers. The purpose of this study was to display a model of team composition that focuses on assembling the team based on roles as opposed to individual attributes as it is commonly done. This group of researchers used an archival data research design consisting of data from major league baseball teams, which they obtained from the Baseball Archive and Retrosheet, between the years 1974 and 2002 (a 29-year period). The pooling of the data gave researchers a total of 778 observations. The dependent variable was team performance (in the form of team winning percentage). The independent variables in this study consisted of career experience (the amount of time a person actually spent performing a certain task in a particular career), team experience (the amount of time a person spent with the team that they are currently working with), job-related skills (level of skill that directly relates to the tasks a person performs daily). The results of this study confirmed that the independent variables (two experience constructs and one skill

construct) are related to higher team performance. It also supported the importance of making sure that core role holders have higher levels of the constructs presented, as it does impact team performance. Finally, the results emphasized the idea that when it comes to financial outcomes, teams that invest more in core roles tend to significantly outperform those teams that do not.

What Makes a Role a "Core Role"?

The extent to which a role can be considered a "core" role can be made evident by a few group features. One of those features consists of the interdependence of the team. Interdependence is defined as "the extent to which the behavior of one team member influences the performance of others" (Aubé & Rousseau, 2005, p. 192). The more core the role is to overall team success, the more the team will be reliant on the behaviors of the person holding the role. It is important to note however, that interdependence can be broken into subsets and should not be treated as one concept. Courtright, Thurgood, Stewart, and Pierotti (2015) recommend that researchers abandon the idea of continuing to use a global operational definition of interdependence because their research indicates that there are different facets of the construct: task interdependence, goal interdependence, and outcome interdependence. Further to this point, the researchers involved in the Courtright et al. (2015) study probably hoped that the results of their study would push other researchers ensure that they indicate exactly which type of interdependence they are analyzing in their studies. The current study will analyze task interdependence, which is defined as "the degree to which taskwork is designed so that members depend upon one another for access to critical resources and create workflows that require coordinated action" Courtright, et al., 2015, pg. 1828).

A core role among a team can also be identified by communication among the team. Communication is defined as "the transference of information from a sender to a receiver and the meaning inferred" (O'Reilly & Roberts, 1977, p. 674). The transference of information is said to be a mediating variable between group task structure and performance, which suggests that the way information is communicated among the hierarchical structure of the team does influence overall team performance. The results of a meta-analysis conducted by Mesmer-Magnus & DeChurch (2009) indicated that information sharing, a form of communication, was not only positively related to team performance, but it also was also found to positively predict knowledge integration and team cohesion. Information sharing comprises of "team communication related to goals, progress, coordination, and the like" and is "independent of the initial distribution pattern of information among team members" (Mesmer-Magnus & DeChurch, 2009, p. 535). This suggests that the more teams communicate, the better team performance will be when critical information is being communicated. Based on the research on core roles, however, the fact that a role is considered "core" suggests that it is involved with almost every aspect of a team's task. This could support an argument that communication to and through the person holding the core job role is vital for team success. Additionally, the results of this meta-analysis indicated that the uniqueness of the information being shared will have a greater impact on team performance than the openness of the information (openness in this study refers to the span of information sharing among the team). These findings support the idea that the frequency and type of information could be considered indicators of core job roles among teams.

Based on the results of a study conducted by Ringuet-Riot (2014), peripheral roles can be thought of as roles that are secondary to the primary role. A peripheral role does not require as much commitment and does not have as much visibility or influence on the overall team performance. Essentially, a peripheral role can be thought of as any role that is not considered to be a core role. Persons in these roles usually assist the person or persons holding the core job roles. This does not mean, however, that they are not needed because if they were not, the task would not be considered a group task. Though peripheral roles are necessary for group goal achievement, they are not as important for overall group success individually, like core job roles are.

Core Roles and Group Performance

In an article which draws upon the foundational research of Humphrey et al. (2009), Ringuet-Riot (2014) asserts that those persons considered to be core volunteers are more critical to the success of voluntary sport organizations than those persons considered to be peripheral volunteers. The explanation that was given for this was that:

> they [core volunteers] encounter more of the problems that need to be overcome in the organization, have a greater exposure to the tasks that the organization performs and are more central to the workflow of the organization. (Ringuet-Riot, 2014, p. 119)

In this study, a "core volunteer" was described by "the involvement and commitment levels of volunteers in non-profit organizations" (Ringuet-Riot, 2014, p. 117). Those persons described as core volunteers were more likely to display higher levels of commitment, which manifested itself in the form of holding positions on boards or committees (Ringuet-Riot, 2014). A peripheral volunteer, on the other hand, was

described by Ringuet-Riot (2014) as committing less time than core volunteers, and they were less likely hold any offices or steady positions; Essentially, they were "occasional contributors" (p. 117) as compared to core volunteers (Ringuet-Riot, 2014). Ringuet-Riot's 2014 study provides a possible explanation for differences found among the relationships between both core and peripheral roles and their relation to team performance. Core volunteers tended to be more involved with the job as a result of perceived level of influence (Ringuet-Riot, 2014). According to Ringuet-Riot (2014), These persons felt that they had some control over some of the decisions that were made and had greater organizational impact, which in turn, fostered a greater sense of ability. This ultimately led to higher levels of involvement and commitment. This could also be transferred to the idea of impact among core roles versus peripheral roles among teams in other contexts.

Another potential explanation as to why core roles have greater impact on team performance than peripheral roles is the fact that these core roles require a certain level of expertise. Expertise was mentioned previously in reference to the individual contribution of team members, but in a study conducted by Bonner, Baumann, and Romney (2015) the focus was more on how this expertise impacts the entire team as it relates to motivation as opposed to cognitive ability. The results of this study demonstrated that experts who prove to have expertise in domains that are considered highly instrumental to the accomplishing of a task tend to feel greater feelings of obligation and are more motivated to succeed in those domains than other members of the team. This suggests that the importance of expertise is only as important as the significance of the task domain is essential for the success of the team. If this is correct, then the impact of expertise would

be more critical to performance for a core role than a non-core role. Based on its definition, a peripheral role will not possess levels of high instrumentality, and as a result and would not foster such feelings as a core role would. One could also argue that peripheral roles are the "other members" Bonner et al. (2015) refer to when making the comparison between experts and the rest of the team. These roles are secondary, and even though they are necessary for overall team effectiveness, individually, they do not have as meaningful of an impact as those core job roles. Overall team performance is greatly impacted by the teamwork and processes, as well as, individual contributions. As the research suggests, however, the recognition of a role being core to the task has implications that affect both the individual as well as the team.

A final explanation of the relationship between core roles and team performance as compared to the relationship between peripheral roles and team performance could be one that weaves the idea of self-efficacy and collective efficacy even deeper into the tapestry that is team performance. As mentioned previously, the levels of self-efficacy present among influential persons, in the form of team leaders, directly influences the collective efficacy of the entire team, which in turn influences its performance (Hoyt et al. 2003; Tasa, et al., 2007). Looking again at the definition of a core role given by Humphrey and colleagues (2009), "the role or roles on a team that encounter more of the problems that need to be overcome in the team, have a greater exposure to the task that the team is performing, and are more central to the workflow of the team" (p. 50), a person operating in a core role is most likely going to be an integral part of team success. This observation can lead one to question whether the level of self-efficacy among a person operating in a core role is just as important to team success as their actual

performance is. If the self-efficacy of a person in a core role is high, could one expect the collective efficacy of the entire team to also be high, subsequently leading to overall team successful? Likewise, if the self-efficacy of that team member is low, could the opposite effect be expected? Additionally, the belief in the team's ability to successfully complete the task is also important to team success (Mathieu et al., 2008). The individual belief about the collective efficacy of the team can be thought of as confidence in the team. Does the confidence in the team have a greater impact when held by specific team members? Furthermore, is the level of confidence in the team held by core role holders is more important to team success than the confidence of peripheral role holders?

Routine Performance versus Non-Routine (Adaptive) Performance

Team performance can be thought of in terms of routine and non-routine contexts (LePine, 2013). Routine performance can be characterized by how often the task is performed (LePine, 2003). A routine is formed when groups establish patterns of behavior that become habitual (Gersick & Hackman, 1990). LePine suggests that routines allow members of a team to anticipate the action of other members, reduce uncertainty, and increased efficiency. Non-routine, or adaptive performance, on the other hand can be thought of as anything outside of that routine. In his study looking at the effects of team composition based on team members' cognitive ability and personality on team adaptability, LePine (2003) focuses on role structure adaptation. Role structure adaptation is defined as "reactive and nonscripted adjustments to a team's system of member roles that contribute to team effectiveness" (p. 28). Adaptability on a team-level, is dependent upon how the team members collectively adapt their roles to an unexpected situation. The ability to be able to adjust to the unexpected is reported to be very important for team

effectiveness (Argote & McGrath, 1993) and is said to be bolstered by high levels of dependability, cognitive ability, openness, and achievement (LePine, 2003).

The results of LePine's study, conducted in 2003, indicated that the demands placed on a team performing a routine task significantly differ from the demands placed on a team performing a task with unforeseen changes. LePine (2005) found that adaptive and routine performance were not highly correlated with one another (r = .38). A more recent study found that the correlation between routine team performance and adaptive performance alone was -.01 (Littlepage &Wertheimer, 2017), which further supports the idea that these two contexts of performance differ. The vast differences among these two contexts of performance implies that the impact core roles have on one context may not be the same for the other context. These findings suggest that these two contexts are not synonymous and for that reason they should be examined and assessed differently.

The current study will ultimately look at the relationship between team member collective efficacy beliefs, individual performance, and overall team effectiveness, but beyond this commonly studied relationship, the effects of the "coreness" of a role on this relationship will also be examined. The study will also examine these relationships for both routine and non-routine performance situations.

Hypothesis 1a: There is a positive relationship between individual *taskwork* performance and team effectiveness.

Hypothesis 1b: There is a positive relationship between individual *teamwork* performance and team effectiveness.

Hypothesis 2a: There will be a stronger relationship between individual *taskwork* performance and team effectiveness for core roles than for peripheral roles.

Hypothesis 2b: There will be a stronger relationship between individual *teamwork* performance and team effectiveness for core roles than for peripheral roles.

Research Question 1: Do the hypothesized relationships hold true for non-routine (adaptive) performance versus routine performance?

Research Question 2a: Is the level of confidence in the team among persons in core roles related to overall team effectiveness?

Research Question 2b: Is this relationship stronger for those persons in core roles than those persons in peripheral roles?

CHAPTER TWO: METHOD

Participants

Participants in this study consisted of senior aerospace students at Middle Tennessee State University who participated in the NASA Flight Operations Unified Center Simulation (FOCUS) Lab. The FOCUS Lab is a simulation laboratory class that is a part of the capstone course required by the aerospace curriculum. Participants were divided among forty teams, each team with nine to ten participants per team. Two core roles and two peripheral roles were analyzed per team, giving us a total of 160 participants whose data were assessed. This study was approved by the Middle Tennessee State University Institutional Review Board. The approval form appears as Appendix A.

Procedure

This study will utilize an archival research methodology. Previously, the data were collected as follows. Prior to participation in the simulations, the aerospace students were onboarded and then assigned to specific roles on a simulated airline team. During the onboarding, the students were given a job orientation which outlined their tasks as team members at *Universal E-Lines*, the name of the simulated airline. These tasks aligned, as closely as possible, to their aerospace disciplines. In order to increase the fidelity of the flight simulations, the students were advised that they should treat this lab portion of the class like it is a real job. In addition to their tasks, the main objectives and expectations during the simulations were introduced to the students. The major expectations included that the students: engage in high levels of teamwork, act professionally and ethically, seek to creatively solve problems and reach high levels of job performance, and most importantly, adhere to the Federal Aviation Administration's

safe flight regulations. In addition to fulfilling a course requirement, the major benefits of being involved in the laboratory simulations were evident in the professional development the students gained. Informed consent was provided to the students asking if they were willing to participate in data collection, in the form of questionnaires, following the flight simulations and be observed by trained evaluators.

The simulated airline includes 30 aircraft, two hub airports, and 14 spoke airports (these are airports which typically act as final destination airports, but are also used to connect to hub locations) all over the southeastern United States. There were primarily ten positions that were created to represent the key functions of a small regional airline. Those positions include: Flight Operations Coordinator (FOC), Maintenance Control, Maintenance Planning, Crew Scheduling, Weather Operations, Ramp Tower, Flight Scheduling (FOD 1), Flight Planning (FOD 2), Pilot, and Pseudo Pilot.

The four positions hypothesized to be represented in this study include FOC, FOD2, Crew Scheduling, and Ramp Tower, and a brief description of each of these positions will be given below. The FOC had the responsibility of ensuring that the airline was running as efficiently and smoothly as possible. This involved clearing all flight departures, and making all of the final decisions related to all flights. For the FOD2 position, responsibilities include fuel, passenger, and cargo management for each flight. The role of Crew Scheduling primarily involved being responsible for all crew members. Some of their tasks included tracking all crew members' duty times and medical statuses to ensure they were legally able to fly. Finally, the Ramp Tower position operated from one of the hub airports, and had the primary responsibility of requesting releases of

flights for departure and making sure that arriving flights were being systematically directed to the appropriate gate numbers.

Flight Simulations

There were two or three simulations in which each of the approximately 50 teams participated. Each simulation lasted about two and a half hours, and required each team to routinely ensure that it is dispatching flights on time, abiding by Federal Aviation Regulations, and minimizing the penalties that come as a result of violating company policies. During each simulation, the team also experienced "triggers" that were introduced to evaluate the effectiveness of the processes and outcomes of the team's troubleshooting abilities. Triggers can be described as systematic introductions of troublesome situations during the simulation that require team members to work together, utilizing collaboration skills to solve the problems effectively. Examples of triggers included the pilot breaking his or her arm prior to the flight, a passenger heart attack, and an airport security closure. Due to knowledge of potential barriers to success that are normally faced by airlines, the lab staff proved to be appropriate judges of the adequacy of team responses to triggers. Trigger response of effectiveness represents one measure of team performance. The simulation software that was used yielded its own performance measure, which reflected the efficiency of the flight operations team in terms of financial outcomes (or financial performance). Trigger effectiveness was used to assess adaptive performance and financial information was used to assess routine performance. The FOCUS Lab staff was generally comprised of six to eight persons who observed the simulations in an effort assess overall team performance as well as the individual

performance of each team member. A more detailed description of the lab can be found in Littlepage, Hein, Moffett, Craig and Georgiou (2016).

Measures

Role criticality measures. These measures, developed locally, aimed to assess the dimensions of communication and task interdependence among the simulations in the FOCUS Lab. The importance and frequency of communication was measured using the "Communication Patterns" measure (Appendix B). Communication frequency was measured as a separate item from communication importance. To assess communication frequency, the respondents were asked to indicate how frequently they received information from each team member during each simulation. They were also instructed to treat later discussions with the same person about the same or new issues as a separate instance so that the total frequency of communication could be represented. The item was rated on a 5-point Likert scale for each position. Additionally, the similarities between the maintenance positions allowed them to be grouped together). The communication frequency scale contained the following scale anchors: 0 = *Never,* 1 = *Once or Twice*, 2 = *Three to Five Times*, 3 = *Six to Ten Times*, and 4 = *More than Ten Times*. The importance of communication was assessed in a similar fashion, requiring respondents to indicate how important it was to communicate with people in each of the positions (again, excluding the pseudo pilot position and the maintenance positions being grouped together). The item was rated on a 5-point Likert scale 0 = *Not At All Important* to 4 = *Absolutely Essential*.

Task interdependence was assessed using the "Interdependence" measure located in the Appendices (Appendix C). This scale consisted of five items that assessed each

individual team member's perception of dependence on the team and the perception of belonging to the team. The desire to examine interdependence based upon role performance, two of the five items were assessed for this study. The pertinent items required respondents to indicate the level of task dependence he/she had on each individual member of the team, as well as, level of perceived task dependence on his/her particular role. An example of one of the items found on this measure was "Their job performance is heavily dependent upon me." Each item was rated on a ten point Likert scale 1 and 2 = *Strongly Disagree,* 5 and 6 = *Neutral*, and 9 and 10 = *Strongly Agree.*

Based on an informal job analysis, we identified the positions of Flight Operations Coordinator (FOC) and Flight Planning (FOD2) as core roles and the positions of Crew Scheduling and Ramp Tower as peripheral roles. These measures of task interdependence and communication can provide additional evidence concerning the positions that represent core and peripheral roles. This will be indicated by the extent to which team members rate the interdependence among the team and the frequency and importance of communication.

Individual performance measures. The individual performance measures that are used in the FOCUS Lab were developed by Master's Candidates of an Industrial/Organizational Psychology program as a part of a class requirement. After the initial development of the measures, they were modified and used by the Subject Matter Experts (SMEs) who would be evaluating individual performance during the simulations. There was a total of nine performance measures developed (one for each position of the simulated airline), four of which will be included in the Appendices (Appendix D). Even though there were ten positions, the similarities between the maintenance positions

allowed them to utilize the same measure. To reiterate, the hypothesized positions that will be assessed in this study include Flight Operations Coordinator (FOC) and Flight Scheduling (FOD2), and Crew Scheduling and Ramp Tower to represent, respectively, two core roles and two peripheral roles. These individual performance measures were developed using a positional job analysis method which included questionnaires, observations, and interviews with SMEs. This process provided the basis for the development of the items that would later be used to distinguish between the different levels of positional performance. The items that were developed were then categorized by taskwork and teamwork job dimensions, and then Behavioral Observational Rating Scales were developed.

Individual performance measures for each position on the airline team were completed by one to three members of the FOCUS Lab staff. Prior to the start of the simulation, members of the research team were assigned up to three specified positions to observe during each simulation. Following the simulations, each staff member was asked to rate the items on individual performance measures to best represent each participant's behavior for the duration of the simulation. The members of the FOCUS Lab staff that completed the individual ratings were believed to be SMEs due to their extensive knowledge of the roles for the positions they assessed. The measure used to assess of individual performance measured two dimensions: individual performance and teamwork. The first part of this measure was used to assess individual taskwork performance. Taskwork items consisted of up to seven items and differed across positions to reflect the job-specific duties of each position. An example of an item found on the individual performance scale for the FOC was "Makes effective decisions to resolve

unusual events." The items that pertained to individual task performance were specific to each position. Each item was rated on a seven point Likert scale 1 = *Never* and 7 = *Always*.

Interpersonal teamwork performance. To assess participants' interpersonal teamwork processes, the final three items found on the individual performance measure were used to capture the teamwork behaviors. An example of an item found on the scale was "Shares relevant information as needed with other team members." Each item that measured teamwork performance was the same for each position (not position-specific). Each item was rated on a seven point Likert scale 1 = *Never* and 7 = *Always* (Appendix D).

Collective-efficacy measure. This measure was adapted from Quiñones (1995) and used by FOCUS Lab researchers to uncover the perceptions of the team's expected performance by individual members of the team. This self-report was taken by each team member prior to the simulation and consisted of ten items. An example of an item found on the scale was "I feel confident in my team's ability to perform the simulation." Each item was rated on a five point Likert scale 1 = *Strongly Disagree* and 5 = *Strongly Agree* (Appendix E). Typically, members responses are aggregated to create a group-level measure of collective efficacy. Because this study contrasts core and peripheral roles, the individual ratings of collective team efficacy were utilized. This, individual level measure represents the individual's confidence that the team will perform well. The estimated level of confidence held by individual team members will be analyzed in order to examine the relationship between the core role holder's beliefs about the team's ability to successfully complete the task and the overall team performance. More specifically, this

measure will be used to assess whether the beliefs of the team members holding core roles will be able to predict overall team performance.

Team performance measures: Computerized data. One method of assessing team performance at the FOCUS Lab consists of analyzing a computerized data measure that quantifies simulated delay loss incurred by the team during each simulation. This measure of team performance was presented to the teams during the After Action Review process, which was a debriefing used to improve team learning and performance. During this meeting, the team was able to reflect on their previous performance and make action plans for future simulations.

Delay loss values were calculated based on the efficiency with which flights were dispatched. The calculations were based on industry standards and relevant formulas. The effectiveness of team performance was indicated by the lack of delay loss. Lower levels of revenue loss indicate a successful team. Because delay loss reflects efficiency of normal airline operations of dispatching flights, it represents our measure of routine performance.

Team performance measures*:* **Trigger response effectiveness***.* This measure was also developed by FOCUS Lab researchers to measure the effectiveness with which participants resolve complex situations that emerge during the flight simulations. This measure targets a specific situation defined by the FOCUS Lab staff, that would specifically impact overall team outcome. For each trigger the members of the staff discussed what an ideal response to the situation would be and compared it to the observed team response. This discussion took place after each simulation, and this was then followed by the individual completion of the trigger response effectiveness measure

by each staff member that observed the simulation. Specific to this study, this measure represented a measure of adaptive team performance. Both the intensity level of and response to an introduced trigger were evaluated. For this study, the focus was on the effectiveness of the response to the trigger. The response to the trigger was evaluated on a seven-point Behaviorally Anchored Rating Scale (BARS) 1= *Extremely Ineffective* and 7= *Extremely Effective* (Appendix F). The effectiveness ratings for each of the triggers encountered during the simulation were averaged to yield an overall measure of adaptive performance. Earlier simulations rated performance on a Likert scale, while later simulations were rated using BARS. As such, the scores were standardized so that they could be combined for data analysis.

The Studies

The research presented was conducted in two parts. The purpose of Study 1 was to evaluate our assessment of the core roles and peripheral roles are among the FOCUS Lab. The purpose of Study 2 was to test the hypotheses presented in the literature review.

Study 1: Role comparison selection. The decision of which roles to use for this study was based on an informal job analysis. Again, the positions of FOC and FOD2 were identified as core roles and the positions of Crew Scheduling and Ramp Tower were identified as peripheral roles. Study 1 provides empirical evidence of the relative standing of these four positions on the following dimensions: task interdependence, communication frequency, and communication importance. The results of statistical analyses assessing these variables was used to evaluate our initial assessment of which roles are core roles and which roles are peripheral roles. Essentially, these variables were used as manipulation checks in this study.

Study 2: Testing the hypotheses and addressing the research questions. The purpose of Study 2 will be to test the hypotheses of this study. The overall relationship between individual and team effectiveness will be examined with Hypothesis 1, and based upon the results of Study 1 the remaining hypothesis (2) which speak to the moderation of core roles on the relationship between the two variables will be assessed. All of the research questions, which address routine versus adaptive performance and the impact of self-efficacy, will also be addressed in Study 2.

CHAPTER THREE: RESULTS

Study 1

Measures of the importance of communication and the frequency of said communication, along with interdependence, were used to verify the selection of core and peripheral roles in the FOCUS lab. These measures indicate the extent to which team members indicate task interdependence, frequent communication, and importance of communication with each position. A series of ANOVAs were used to compare positions on these dimensions. After analyzing the results, positions that receive the highest rating are considered core roles, while positions receiving the lowest ratings are considered peripheral roles. This is consistent with the definition of core roles, which again is defined as "the role or roles on a team that encounter more of the problems that need to be overcome in the team, have a greater exposure to the task that the team is performing, and are more central to the workflow of the team" (Humphrey, et al., 2009, p. 50).

Descriptive statistics for the scores received on each measure are shown in Tables 1, 2, 3, and 4. As previously mentioned, there are ten positions among each team, so in order to determine which roles would be considered core roles and which roles would be considered to be peripheral roles, analyses were conducted in order to objectively make these decisions. Based on an informal task analysis, we suspected that the FOC and FOD2 were the most critical roles while the Ramp and Crew scheduling were the least central.

Study 1 was designed to empirically evaluate the extent to which the positions of FOC and FOD2 represent core roles and that the positions of Crew Scheduling and Ramp Tower represent peripheral roles. The criteria we used to determine the extent to which a

role was considered core or peripheral were the levels of reported task interdependence and communication. More specifically, the questions “How important do other members of the team think it is to communicate with you?”, “How frequently do other members of the team communicate with you?”, “How heavily do you depend on other members of the team?”, and “How heavily do other members of the team depend on you?” were used to assess the extent to which a role was considered to be a core role.

Table 1
Descriptive Statistics for Score Received on Communication Importance

Position	Mean	SD
FOC	3.58	.80
FOD2	1.94	1.41
Ramp Tower	1.94	1.42
Crew Scheduling	1.81	1.39

N = 62

Table 2
Descriptive Statistics for Score Received on Communication Frequency

Position	Mean	SD
FOC	3.11	1.29
FOD2	1.31	1.43
Ramp Tower	1.03	1.11
Crew Scheduling	1.20	1.37

N = 59

Table 3

Descriptive Statistics for Score Received on Interdependence Scale (My Job Depends On…)

Position	Mean	SD
FOC	8.81	1.81
FOD2	7.86	2.22
Ramp Tower	7.61	2.29
Crew Scheduling	7.80	2.42

N = 47

Table 4

Descriptive Statistics for Score Received on Interdependence Scale (…Job Depends on Me)

Position	Mean	SD
FOC	8.79	1.72
FOD2	8.32	2.16
Ramp Tower	7.55	2.60
Crew Scheduling	7.66	2.58

N = 47

A One-Way Repeated-Measures ANOVA was used to evaluate the interdependence and communication dimensions among the team. The One-Way Repeated-Measures ANOVA (*alpha* = .05) indicated that the frequency of communication between team members differed by position, *Wilk's Lambda F* (6, 53) = 18.01, $p < .001$. The Sidak procedures indicated that the communication was more frequent with the FOC position than it was with the FOD2, the Ramp Tower, and the Crew Scheduling positions. The One-Way Repeated-Measures ANOVA (*alpha* = .05) indicated that the importance of communication between team members differed by position, *Wilk's Lambda F* (6, 56) = 15.99, $p < .001$. The Sidak procedures indicated that

the communication with the FOC position was thought to be more important than it was with the FOD2, the Ramp Tower, and the Crew Scheduling positions. The One-Way Repeated-Measures ANOVA (*alpha* = .05) indicated that the extent to which positions thought that their jobs depended on other team members also differed by position, *Wilk's Lambda F* (6, 43) = 3.18, *p* = .011. The Sidak procedures indicated that participants thought their job was more dependent on the FOC than the FOD2, Ramp Tower, and the Crew Scheduling positions. Finally, the One-Way Repeated-Measures ANOVA (*alpha* = .05) indicated that the extent to which positions thought other team members' jobs depended on them also differed by position, *Wilk's Lambda F* (6, 41) = 3.91, *p* = .004. The Sidak procedures indicated that the participants thought that the positions Ramp Tower and Crew Scheduling were less dependent upon them than was the FOC position. , The FOC and FOD2 did not differ in perceived dependence on other positions.

Descriptively, scores for FOC were higher than all other positions across all four items. The results also indicated that the FOC position scored significantly higher than the Ramp Tower position on all four items and higher than the Crew Scheduling position on three of the four items. Descriptively, the FOD2 position with this FOD2 position received the second-highest ratings across items. All in all, FOC is clearly the most core role. Although evidence for FOD2 is weaker, the overall pattern is for FOD2 to appear to be the next most core position while the Ramp and Crew Scheduling positions are somewhat more peripheral. Descriptively, FOD2 scored higher than Crew Scheduling on all four dimensions. FOD2 received the same score as Ramp Tower on one dimension (communication importance), but scored higher on the other three dimensions. See Tables 5, 6, 7, and 8 for pairwise comparisons.

Table 5
Sidak Pairwise Comparisons for Positions on Communication Frequency

(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	Upper Bound
FOC	FOD2	1.81*	1.16	2.47
	Ramp Tower	2.09*	1.41	2.76
	Crew Scheduling	1.92*	1.26	2.58
FOD2	Ramp Tower	.27	-.28	.82
	Crew Scheduling	.10	-.25	.45
Crew Scheduling	Ramp Tower	.169	-.35	.68

Table 6
Sidak Pairwise Comparisons for Positions on Communication Importance

(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	Upper Bound
FOC	FOD2	1.65*	1.01	2.28
	Ramp Tower	1.65*	.98	2.31
	Crew Scheduling	1.77*	1.16	2.38
FOD2	Ramp Tower	.00	-.71	.71
	Crew Scheduling	.13	-.20	.46
Ramp Tower	Crew Scheduling	.13	-.20	.46

Table 7
Sidak Pairwise Comparisons for Positions on Interdependence Scale (My Job Depends On…)

(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	Upper Bound
FOC	FOD2	.96*	.03	1.89
	Ramp Tower	1.20*	.22	2.17
	Crew Scheduling	1.02	-.00	2.05
FOD2	Ramp Tower	.25	-.66	1.15
	Crew Scheduling	.06	-.75	.87
Crew Scheduling	Ramp Tower	.18	-.54	.90

Table 8
Sidak Pairwise Comparisons for Positions on Interdependence Scale (…Job Depends on Me)

(I)	(J)	Mean Difference (I-J)	95% CI Lower Bound	Upper Bound
FOC	FOD2	.47	-.17	1.11
	Ramp Tower	1.23*	.22	2.25
	Crew Scheduling	1.13*	.00	2.25
FOD2	Ramp Tower	.77	-.21	1.74
	Crew Scheduling	.66	-.36	1.68
Crew Scheduling	Ramp Tower	.11	-.85	1.06

Our informal job analysis suggested that the FOC and FOD2 positions represent core roles while the Crew Scheduling and Ramp Tower positions represent peripheral roles. Study 1 clearly indicated that FOC was a core role and Crew Scheduling and Ramp Tower were peripheral roles. Results of Study 1 were more ambiguous concerning the appropriate classification of the FOD2 position. Although Study 1 assessed dimensions of communication and task interdependence that may be reflective of core roles, it did not specifically ask participants to designate each of the positions as core or peripheral roles. To further assess the designation of specific positions as core and peripheral roles, ten subject matter experts (SMEs) were asked to identify positions that represented core roles. All were members of the FOCUS-Lab staff and had experience observing the simulations. The FOC position was designated as a core role by all ten SEMs and the FOD2 position was designated as a core role by nine SMEs. Crew scheduling was designated as a core role by one SME and the ramp tower position was not designated as a core role by any SME. Their responses supported the designation of the FOC and FOD2

positions as core roles and the designation of Ramp Tower and Crew Scheduling as peripheral roles in this study.

Study 2

Table 9 shows basic descriptive statistics (including scores on the performance outcome measures). Based on previous literature, it was hypothesized that the individual performance of persons in Core Roles would not only have a large impact on overall team performance, but also that it would have a greater impact than performance of those in Peripheral Roles.

Table 9
Basic Descriptive Statistics

Variable	*n*	*M*	*SD*
Core Taskwork	146	4.71	.93
Core Teamwork	146	4.87	.967
Peripheral Taskwork	144	5.24	1.10
Peripheral Teamwork	144	5.08	1.16
All Taskwork	146	4.97	.74
All Teamwork	146	4.97	.85
Delay Loss ($)	148	29,419.74	14,938.25
Trigger Response Effectiveness (standardized scores)	147	.00	.99

As a preliminary assessment of the relationship between individual performance and team performance, correlations were computed between both overall individual taskwork performance and overall individual teamwork performance and the two measures of team performance (delay loss and trigger response effectiveness). For these analyses, responses for persons in all four roles were included. The results indicated that there was a significant correlation between overall taskwork (including all four roles) and

delay loss ($r(147) = -.244$, $p = .003$). There was also found to be a significant correlation between overall taskwork (including all four roles) and trigger response effectiveness ($r(146) = .480$, $p = .001$), demonstrating support for *Hypothesis 1a*.

Hypothesis 1b was also supported, with results indicating a significant correlation between the teamwork for all roles and delay loss ($r(147) = -.249$, $p = .003$). The correlation between the teamwork for all roles and trigger response effectiveness was also found to be significant ($r(146) = .489$, $p = .001$). See Table 10 for Pearson correlation statistics. These results indicate that generally, for all roles, both the individual teamwork and the individual taskwork of each group member is correlated with how effective the group is overall.

Table 10
Pearson Correlation Matrix among Individual Performance and Performance Outcome Measures

	Delay Loss	Trigger Response Effectiveness	All Taskwork	All Teamwork
Delay Loss	--			
Trigger Response Effectiveness	-.137	--		
All Taskwork	-.244**	.480**	--	
All Teamwork	-.249**	.489**	.862**	--

**$p < 0.01$

After looking at the preliminary relationship between performance of all roles and performance outcomes, the relationship between the performance data of core roles and each performance outcome measure was assessed. The same was then done for the

peripheral roles. The results indicated that there were significant correlations between all core performance components (team and task) and performance outcome measures (delay loss and trigger response effectiveness). When it came to peripheral roles, however, there were smaller, but significant correlations between the taskwork and teamwork component for trigger response effectiveness but not for delay loss. These results are reported in detail in the sections that follow. More specifically, there was a significant correlation found between core taskwork and delay loss ($r(147) = -.248$, $p = .003$), but not between delay loss and peripheral task performance ($r(147) = -.108$, $p = .200$). On the other hand, there were significant correlations between both core taskwork and peripheral taskwork and trigger response effectiveness, but the correlation was stronger for core taskwork than peripheral taskwork *(*$r(146) = .441$, $p < .001$ and $r(146) = .269$, $p = .001$, respectively). This demonstrates support for *Hypothesis 2a.*

The results for the assessment of teamwork mirrored those obtained for taskwork. There was a significant correlation between core teamwork and delay loss ($r(145) = -.242$, $p = .004$), but not between delay loss and peripheral teamwork performance ($r(147) = -.135$, $p = .110$). There were also significant correlations between both core teamwork and peripheral teamwork and trigger response effectiveness. The strength of the correlation for core teamwork was again stronger peripheral teamwork, however, *(*$r(146) = .459$, $p < .001$ and $r(146) = .333$, $p = .001$), respectively. This demonstrates support for *Hypothesis 2b.* See Table 11 for Pearson correlation statistics.

Table 11
Pearson Correlation Matrix among Core and Peripheral Role Performance and Performance Outcome Measures

	Delay Loss	Trigger Response Effectiveness	Core Taskwork	Core Teamwork	Peripheral Taskwork	Peripheral Teamwork
Delay Loss	--					
Trigger Response Effectiveness	-.137	--				
Core Taskwork	-.248**	441**	--			
Core Teamwork	-.242**	.459**	.843**	--		
Peripheral Taskwork	-.108	.269**	.308	.180*	--	
Peripheral Teamwork	-.135	.333**	.199*	.289**	.813**	--

**$p < 0.01$; *$p < 0.05$

Further support for the hypotheses were seen in the results of a series of hierarchical regressions. As a feature of the FOCUS lab, the simulations became more challenging for each team as they progressed through them (i.e., simulation 3 contained more challenging triggers than simulation 1). As such, there was added value to analyzing the relationship between task and teamwork performance and performance outcomes while controlling for difficultly of the simulation itself. The purpose of conducting this analysis was to assess whether or not the hypothesized relationships would be impacted by the difficulty of the simulations. As a result, hierarchical regressions were conducted to assess these relationships. In these analyses, simulation number (1, 2, or 3) was entered in the first step and the independent variable (core taskwork, peripheral taskwork, core teamwork, or peripheral teamwork) was entered in the second step. Significant increases in R^2 for step 2 indicate a significant relationship

between the predictor and criterion variable. These analyses demonstrated that, when controlling for simulation number, the task and teamwork pooled across all four roles had a significant relationship with the performance outcome measures. See Table 12.

Results of the hierarchical regression also demonstrated that core roles were still found to have a greater impact on overall team performance. When assessing the impact of performance on delay loss while controlling for simulation number, both core taskwork and core teamwork performance were found to be significantly related to team performance, F (1, 141) = 7.12, p = .03, R^2 change = .03 and F(1, 141) = 6.88, p = .04, R^2 change = .03, respectively. These findings indicate that when controlling for simulation number, the task performance of core roles accounted for 3% of the variance when predicting delay loss. Similarly, core role individual teamwork performance was also found to account for about 3% of variance when predicting delay loss as well. While these analyses indicate that performance of core roles affected delay loss, these effects were of modest size.

The impact of peripheral roles on delay loss was not demonstrated, however. Neither peripheral role individual taskwork, F(1, 139) = 4.94, p = .36, R^2 change = .01, nor peripheral role individual teamwork F(1, 139) = 4.95, p = .35, R^2 change = .01, were found to be significantly related to delay loss. See Table 12 for changes in R^2 for delay loss.

When assessing the impact of performance on trigger response effectiveness there were slight differences in the results. While controlling for simulation number, both core individual taskwork and core individual teamwork performance were found to be significantly related to team performance, F (1, 140) = 19.92, p < .001, R^2 change = .22

and $F(1, 140) = 22.43$, $p < .001$, R^2 change = .24, respectively. These findings indicate that when controlling for simulation number, the taskwork performance of core roles accounted for 22% of the variance when predicting trigger response effectiveness. Teamwork performance of core role members was found to account for 24% of the variance when predicting trigger response effectiveness.

While assessing the impact of performance on trigger response effectiveness while controlling for simulation number the taskwork of peripheral role holders was found to be significantly related to performance $F(1, 138) = 5.57$, $p = .001$, R^2 change = .07. Similarly, peripheral member teamwork was also found to be significantly related to performance $F(1, 138) = 9.41$, $p < .001$, R^2 change = .12. These results indicate that when controlling for simulation number, the taskwork performance of peripheral roles accounted for 7% of the variance when predicting trigger response effectiveness. Teamwork performance of those in peripheral roles was found to account for 12% of the variance when predicting trigger response effectiveness. See Table 13 for changes in R^2 for trigger response effectiveness. Comparisons of regression weights for core teamwork and peripheral teamwork reveal that the confidence intervals for these dimensions do not overlap. This indicates that the impacts of core teamwork are significantly greater than the impacts of peripheral teamwork. Similarly, the regression weights for core and peripheral taskwork also indicate that the confidence intervals for these dimensions do not overlap. Overall, these results indicate that core roles have a greater impact on team performance than peripheral roles.

Table 12
Changes in R^2 for Delay Loss

Model 1*				Model 2*		
p	*R*	R^2	Variable	*p*	*R*	Change in R^2
.003	.244	.060	Core Taskwork	.027	.303	.032
.003	.244	.060	Core Teamwork	.035	.298	.029
.003	.246	.061	Peripheral Taskwork	.358	.258	.006
.003	.246	.061	Peripheral Teamwork	.354	.258	.006
.003	.244	.060	All Taskwork	.027	.303	.032
.003	.244	.060	All Teamwork	.032	.300	.030

*Simulation number is the only predictor in Model 1. Model 2 adds the substantive predictor indicated above.

Table 13
Changes in R^2 for Trigger Response Effectiveness

Model 1*				Model 2*		
p	*R*	R^2	Variable	*p*	*R*	Change in R^2
.805	.021	.000	Core Taskwork	.000	.471	.221
.805	.021	.000	Core Teamwork	.000	.493	.243
.830	.018	.000	Peripheral Taskwork	.001	.273	.074
.830	.018	.000	Peripheral Teamwork	.000	.346	.120
.805	.021	.000	All Taskwork	.000	.507	.257
.805	.021	.000	All Teamwork	.000	.529	.279

*Simulation number is the only predictor in Model 1. Model 2 adds the substantive predictor indicated above.

In order to assess *Research Question 1*, the results of Hypotheses 2a and b were reviewed with a specific focus on the ability of the hypothesized relationships to be supported for both routine and adaptive performance. Delay loss was conceptualized as

an indicator of routine performance while trigger response effectiveness was regarded as reflecting adaptive performance. Results indicated that the hypothesized relationships between the individual taskwork and teamwork performance of those in core roles with performance outcomes did hold true for both non-routine and routine performance. The taskwork performance of those in core roles was found to have significant correlations with both routine (delay loss) ($r(147) = -.25$) and non-routine (trigger response effectiveness) ($r(146) = .44$) performance. Likewise, teamwork performance of those in core roles was related to both routine performance ($r(145) = -.24$) and non-routine performance ($r(146) = .46$).

On the other hand, both taskwork and teamwork performance of those in peripheral roles were related to non-routine team performance, but not to routine team performance. The correlations between taskwork and teamwork performance of peripheral team members were correlated with the non-routine performance (trigger response effectiveness) ($r(146) = .27$ and $r(146) = .33$, respectively). Neither taskwork or teamwork of peripheral members was related to routine (delay loss) performance ($r\ (147) = -.11$ and $r\ (147) = -.14$, respectively). These results suggest that that the impact of core roles will be significant regardless of if the team is performing a routine task or a non-routine task. The impact of peripheral roles, on the other hand, will be significant for non-routine task, but not necessarily for routine tasks. Ultimately, results indicated that the relationships between individual performance (both taskwork and teamwork) and team effectiveness were stronger for the performance of non-routine tasks.

The analysis of the delay loss measure indicated that there was a significant relationship between simulation number and performance outcome. This finding could

explain the reason that delay loss was found to increase as the simulations progressed from simple simulation 1 to a more complex simulation 3. The results also indicate that one possible suggestion for the finding of trigger response effectiveness not increasing with simulation number could be due to the fact that there were more triggers being introduced as the simulations progressed. When looking at the results of the relationship between simulation number and both performance outcome measures together, results suggest that participants were getting better at performing routine tasks as the simulations progressed, but this was offset by the fact that the triggers were getting progressively harder.

Research Question 2a was focused on the relationship between collective efficacy and overall team performance among persons in core roles. Based on the extant literature, we expected find a significant relationship between the two variables. Interestingly, results of a correlation indicated that the level of confidence in the team among persons in core roles was related to non-routine performance, ($r(146) = .313$, $p < .001$), but not to routine performance, ($r(147) = .077$, $p = .371$). *Research Question 2b* focused on whether or not the relationship being examined in Research Question 2a would be stronger than the relationship between the collective efficacy and overall team performance among persons on peripheral roles. Results indicated that there was no relationship found between the collective efficacy of a person acting in a peripheral role and routine performance ($r(147) = -.113$, $p = .196$) or non-routine performance ($r(146) = .135$, $p = .124$). See Table 14 for descriptive statistics and Table 15 for Pearson correlation statistics.

Table 14
Basic Descriptive Statistics for Collective Efficacy Scores

Variable	*n*	*M*	*SD*
Core Collective Efficacy	140	4.20	.58
Peripheral Collective Efficacy	134	4.18	.62

Table 15
Pearson Correlation Matrix among Collective Efficacy and Overall Team Performance

	Core Collective Efficacy	Peripheral Collective Efficacy	Delay Loss	Trigger Response Effectiveness
Core Collective Efficacy	--			
Peripheral Collective Efficacy	.270**	--		
Delay Loss	.077	-.113	--	
Trigger Response Effectiveness	.313**	.135	-.137	--

**$p < 0.01$

As such, the results suggest that the relationship between the collective efficacy of a person in a core role and team performance is stronger than those persons in peripheral roles when it comes to non-routine performance, but not for routine performance due to the lack of relationship found. Taken together, however, one could argue that even though collective efficacy is related to the performance of non-routine tasks, it cannot be said that the collective efficacy of persons in core roles is related to overall team performance because there is no correlation to routine tasks as well.

CHAPTER FOUR: DISCUSSION

Using the team members of a simulated airline company, the results of this study demonstrate support for the idea that taskwork and teamwork are distinct concepts, both having their own individual impact on overall team success (Crawford & Lepine, 2013). They also also confirm that core roles have a greater impact on overall team success than peripheral roles do (Ringuet-Riot, 2014). Further, results also indicated that the ability for core roles to significantly impact overall team performance is found to be true regardless of the type of task being performed, be it routine or non-routine. These results add to the study of teams and teamwork in that they support the idea that the individual performance of a core role holder among a team can have a great impact on the overall team's success. This study also takes it a step further, however, analyzing and making the direct comparison between the impact of both taskwork and teamwork behavior of core roles and non-core, or peripheral, roles on team performance. Further, the study indicates that the effects of core roles is found for both routine and non-routine performance. On the other hand, the effects of peripheral role performance appear limited to performance in non-routine situations.

Implications of the Results

Predictably, the results indicated that there was a significant correlation between individual teamwork behavior and overall team performance. These results support the idea that the effectiveness of the team is impacted by the ability of the team to work together. A significant relationship was also found between individual taskwork and overall team performance, further supporting literature that emphasizes the importance of the individual work of each member of the team. Ultimately, these findings demonstrate

that in this study, both the teamwork and the taskwork of individual team members (for all 4 roles) are correlated with how the group performs. Taskwork and teamwork are conceptually different concepts, but they seem to be highly related. This relationship is typically common for highly interdependent tasks and the results of this study demonstrate a strong correlation (r (145) = .862, p < .001) between the two supporting this idea. Interestingly, the strength of the correlation for each relationship was very similar, with the correlations among individual teamwork and team performance being a little higher for both outcome measures (Refer to Table 10). This finding is not surprising, however, due to the fact that the performance of the tasks of the team require the team to actually work together (Crawford & LePine, 2013). The fact that strength found among the relationship between taskwork and team performance is very similar to that of the relationship between teamwork and team performance could also be an indication that the individual performance of each team member is almost just as impactful as his or her joint efforts (teamwork). This extends the research on teamwork because it not only speaks to the relationship between the performance of taskwork and overall team performance (demonstrating that there is a significant relationship), but it also provides insight into the potential strength of that relationship as well.

This research also extends the research on core roles because it examines the impact of both taskwork and teamwork behaviors of those core roles holders more specifically. Additionally, it examines these relationships across two types of tasks: routine and non-routine.

This study also extends the research on adaptive performance. Specifically, this research provides further support for team performance process model developed by

Rosen and colleagues (2011), which details the process by which teams adjust their performance processes to accommodate novel and challenging situations. Findings that individual teamwork performance is related to adaptive team performance is consistent with the Rosen model. Rosen and colleagues suggest that specific teamwork behaviors such as strategy formulation, backup behavior, and affect management are critical for effective team adaptive performance. This research study ultimately expands theory and research on adaptive performance by examining the impact of both individual teamwork and individual taskwork behavior on team adaptation. It also extends the understanding of team adaptive performance by showing that the taskwork and teamwork of team members who occupy core roles and those that occupy peripheral roles contribute to team adaptation.

Findings also extend our understanding of core role theory. When solely focusing on the relationship between core roles and their impact on overall team performance, the results indicate that both the taskwork and teamwork of persons holding core roles significantly impacts overall team performance (including routine and non-routine performance). The same cannot be said for peripheral roles, however. For peripheral roles, a significant relationship was found between the taskwork and teamwork of peripheral roles and the non-routine performance outcome measures. No relation was found between individual performance of those in peripheral roles and routine performance. These results suggest that for core roles, it does not matter whether the team is performing a routine or a non-routine task, the correlation between individual and overall team performance will be significant. This is especially important to consider when composing teams using the role composition approach because it suggests that the

performance of the person in a core role will have a strong influence on how the team performs on both routine and non-routine tasks. Again, the role composition approach suggests that there are some roles that are more important to team success than others even though the contributions of the entire team are known to be important for overall team effectiveness (Humphrey, et al., 2009). This study adds support to this idea.

For peripheral roles on the other hand, these roles will only have a significant relationship with performance when performing non-routine (adaptive) tasks. As such, performance of both core and peripheral roles were found to be more closely related to non-routine performance than to routine performance. This finding supports the idea that routine and non-routine performance are differing constructs (Lepine, 2005; Littlepage &Wertheimer, 2017). One possible explanation for this finding could be the urgent effort required of each individual member of the team, as well as, the need for collaboration and teamwork in order to solve the problem that is associated with non-routine tasks. Remember that as previously stated, non-routine, or adaptive performance, can be thought of as anything outside of the expected and established patterns of behavior (LePine, 2003). In order to combat these issues, every member of the team, core role or not, needs to be attentive, contributing, and acting toward solving the problem. This finding is compatible with what Argote and McGrath (1993) say about an important aspect of effective teams: adaptability. According to those researchers, the ability of a team to adjust to the unexpected events they face, in this case the triggers, is essential for team effectiveness. As such, the fact that non-routine performance is related to both core and peripheral roles demonstrates that regardless of whether a role is core or peripheral it

is going to be essential for the person operating in this role to be adaptive; this ability to be adaptive, or lack thereof, is going to impact the effectiveness of your team overall.

One surprising finding was the fact that the collective efficacy of persons holding the core role positions was not found to be strongly related to all facets of team performance. As indicated in the results section, there was a significant correlation between the collective efficacy of a person in a core role and non-routine performance, but not between the collective efficacy of a person in a core role and routine performance. Previous research has stated that collective efficacy has positive effects on team performance (Mathieu et al., 2008), and that the high self-efficacy of a leader impacts group performance through increased collective efficacy of followers within the group (Stajkovic, Lee, & Nyberg, 2009). This was not the case in this study, however indicated by the weak correlation found between the collective efficacy of a core role holder and the collective efficacy of a peripheral role holder ($r(129) = .270$, $p = .002$). One implication of this study is that just because a position is considered to be a core role does not mean that it is a leadership role, as such, the collective efficacy of the person in that role will not always produce the effects that Stajkovic et al. obtained in their 2009 study. It is important to note, however, that Stajkovic et al (2009) examined self-efficacy while this study looked at collective efficacy, which could explain some of the differences we found.

Another implication of these results has to do with the fact that the belief in the team's ability to successfully adapt its performance to appropriately resolve a novel issue is significantly related to non-routine team performance, but not routine performance. This finding is consistent with the collective efficacy theory, which posits that collective

efficacy can be expected to have its greatest impact when tasks are demanding and high levels of effort are required or success is not certain (Tasa, et al., 2007). This suggests that when performing a predetermined and expected task that, it does not matter what the person in a core role believes about the team's probability of success, but when an unexpected problem occurs, it does matter. Furthermore, this implies that when a novel situation that requires the performance of a new task does arise, the group relies on the confidence in the team held by core role holders. This could mean that even though it may not matter much when routine tasks are being performed, it is good to have a person in a core role who has confidence in the team's ability to effectively function when placed in situations that require adaptably because the team will feed off of that confidence. One possible explanation for this finding could be range restriction. The results in Table 14 indicate that ceiling effects are possible among this study due to the relatively low variability among the scores. Low variability makes it difficult to distinguish the direct relationship between performance and measure, which could explain the lack of relationship indicated.

Again, there was no relationship found between either the collective efficacy of a person acting in a peripheral role and either routine performance or non-routine team performance. This finding is also interesting because according to Stajkovic et al. (2009) the greater the amount of collective efficacy among a team, the greater the level of team performance will be. A peripheral role among teams is characterized as any role that is not a core role, subsequently constituting the majority of the rest of the team members. Due to the fact that these team members most likely outnumber the amount of core roles among the team. As such, one might expect that even if the relationship between the

collective efficacy of a person in a peripheral role and team performance is not as strong as the relationship between team performance and the collective efficacy of a person in a core role, there should at least be some relationship; even if the relationship is weak because the research suggests it should. This was not the case, however. The findings suggest that regardless of what a person in a peripheral role thinks about the probability of group success, it will not have much of an impact on the performance of routine tasks. The same can be said when a non-routine task is being performed.

Limitations and Future Research

This study contributes to literature regarding the composition and performance of teams, and provides insights specifically into the to the impact of core roles on the overall performance of the team. Despite some interesting findings and implications, there are some limitations to this study that are worth noting. First, it is important to note that the results of this study should not be taken to imply causal relationships due to the fact a nonexperimental design was used. Second, the fact that participants in this study were students of the aerospace program at a large university, the ability to generalize these results is limited and should be done with caution when attempted to do so to other populations or settings.

Third, the lack of random assignment of participants due to the relationship between team member role and academic specialization of the participant further prevents there from being direct evidence of causal relationships between the independent and dependent variables. Fourth, there was a possibility for bias among the results of the measures due to the potential influence of other factors on the raters while they were making their judgements. For example, the fact that the staff members of the

FOCUS Lab were completing individual performance measures after the completion of the simulation, could have resulted in some external bias over the individual's performance based on how well, or how poorly, the team performed.

Fifth, the results of the individual performance measures could have been contaminated by the performance of another individual team member. The interdependent nature of the team task implies that the performance of an individual team member is influenced by the performance of another individual (or the team as a whole). Thus, there is some variance in individual performance due to the actions of other team members. Sixth, the informal job analysis demonstrated that FOD2 role was one of the more core roles among the team, but, the results of study 1 did not fully support this. This could be an indication of some deficiencies in the distinction between core and peripheral roles. More specifically, conducting the analyses with just FOC or the FOC and another more statistically comparable core role could have resulted in stronger relationships among the study. Nevertheless, SME responses supported our characterization of FOC and FOD2 as core roles and Crew Scheduling and Ramp Tower as peripheral roles.

Finally, even though the hierarchical regressions accounted for the increasing difficulty of each simulation within the respective semester, there may be differences in the difficulty level of the simulations across the semesters (i.e., the difficulty level of simulations in semester 6 were believed to be different than the difficulty level of simulations in semester 13). In other words, since the conception of the lab, the simulations appear to have been getting harder. The difficulty could have impacted the performance of the roles as they were examined over time. Increasing difficulty across semesters would add error variance which would reduce the sensitivity of statistical tests.

Future research should seek to examine these hypotheses in another type of setting, preferably an organizational setting, to assess this theory in a more applied setting. Beyond that, future research should attempt to assess the causal relationship between individual and team performance with core roles as a moderator. Additionally, the findings that indicated a weak relationship between collective efficacy and overall team performance could indicate an area that requires additional research. It would be interesting to see a similar study conducted with this type of team that focused on assessing the relationship between the collective efficacy of a person in a core role and overall team performance, rather than it being a secondary component of a study. A study like this type of study could potentially provide insight into why this study obtained the results that it did; especially since these results, in some ways, opposed what the literature says (Stajkovic et al., 2009).

Based on previous research on teams and team composition, it was hypothesized that core roles would have a significant relationship with overall performance of a team. Furthermore, the related hypothesis posited that this relationship would be more significant in comparison to the performance of a role considered to be a peripheral role. Results indicated that core roles have a stronger relationship with all facets of team performance than peripheral roles do. Specifically, this relationship was found to be supported for both individual taskwork performance and teamwork performance. Moreover, this relationship was also found to be supported for both the performance or routine and non-routine performance. Individual performance of both taskwork functions and teamwork functions are critical for team effectiveness. This is especially true for

situations requiring adaptation. Based on the results of this study, it is further supported that there are some roles that are more critical to team success than others.

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APPENDICES

APPENDIX A

IRB Approval Form

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

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN007 – EXEMPTION DETERMINATION NOTICE

Wednesday, November 29, 2017

Investigator(s): Olrica Turnquest; Glenn Littlepage; Michael Hein
Investigator(s') Email(s): owt2a@mtmail.mtsu.edu; Glenn.Littlepage@mtsu.edu; Michael.Hein@mtsu.edu
Department: Psychology

Study Title: THE EFFECT OF CORE ROLES ON THE RELATIONSHIP BETWEEN INDIVIDUAL PERFORMANCE AND TEAM PERFORMANCE
Protocol ID: **18-1124**

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 furhter IRB review***	
Date of expiration	NOT APPLICABLE	
Participant Size	Existing Data	
Participant Pool	**FOCUS Lab Existing Data**	
Mandatory Restrictions	Data usage restricted to data collected under MTSU IRB 17-2008	
Additional Restrictions	None at this time	
Comments	None at this time	
Amendments	**Date**	**Post-Approval Amendments**
		None at this time

***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

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

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 sacure 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

Communication Patterns

Please indicate how **frequently** you got or received information from each job assignment. Treat each conversation as a separate instance; that is, if you discussed something count this as one instance. If you later talked with this person about the same issue or another issue count this as a separate instance. If you were the only person in this position, leave the item blank.

0	1	2	3	4
Never	Once or Twice	Three to Five Times	Six to Ten Times	More than Ten Times

	Communication Frequency
Flight Operation Coordinator	
FOD1	
FOD2	
Crew Scheduling	
Weather & Forecasting	
Maintenance Control	
Ramp Tower	
Pilot	

Please indicate how **important** it was to communicate with people in each of the following positions. If you were the only person in this position, leave the item blank.

0	1	2	3	4
Not At All Important	Somewhat Important	Moderately Important	Very Important	Absolutely Essential

	Communication Importance
Flight Operation Coordinator	
FOD1	
FOD2	

	Communication Importance
Crew Scheduling	
Weather & Forecasting	
Maintenance Control	
Ramp Tower	
Pilot	

APPENDIX C

Interdependence Measure

The following questions ask about your perceptions of various airline industry roles. Please respond to each question using the scale below (for each question, select the number that best reflects your response). Please answer open and honestly, there are no right or wrong answers.

(For the position you held, keep the line blank.)

ITEMS		**Strongly Disagree**		**Disagree**		**Neutral**		**Agree**		**Strongly Agree**	
My job performance is heavily dependent on:											
1.	FOC	1	2	3	4	5	6	7	8	9	10
2.	FOD1	1	2	3	4	5	6	7	8	9	10
3.	FOD2	1	2	3	4	5	6	7	8	9	10
4.	Crew Scheduling	1	2	3	4	5	6	7	8	9	10
5.	Weather & Forecasting	1	2	3	4	5	6	7	8	9	10
6.	Maintenance Control	1	2	3	4	5	6	7	8	9	10
7.	Ramp Tower	1	2	3	4	5	6	7	8	9	10
8.	Pilot	1	2	3	4	5	6	7	8	9	10
Their job performance is heavily dependent upon me:											
1.	FOC	1	2	3	4	5	6	7	8	9	10
2.	FOD1	1	2	3	4	5	6	7	8	9	10
3.	FOD2	1	2	3	4	5	6	7	8	9	10
4.	Crew Scheduling	1	2	3	4	5	6	7	8	9	10
5.	Weather & Forecasting	1	2	3	4	5	6	7	8	9	10
6.	Maintenance Control	1	2	3	4	5	6	7	8	9	10
7.	Ramp Tower	1	2	3	4	5	6	7	8	9	10
8.	Pilot	1	2	3	4	5	6	7	8	9	10
I share performance goals with:											
1.	FOC	1	2	3	4	5	6	7	8	9	10
2.	FOD1	1	2	3	4	5	6	7	8	9	10

3.	FOD2	1	2	3	4	5	6	7	8	9	10
4.	Crew Scheduling	1	2	3	4	5	6	7	8	9	10
5.	Weather & Forecasting	1	2	3	4	5	6	7	8	9	10
6.	Maintenance Control	1	2	3	4	5	6	7	8	9	10
7.	Ramp Tower	1	2	3	4	5	6	7	8	9	10
8.	Pilot	1	2	3	4	5	6	7	8	9	10

Please continue to the next page

APPENDIX D

Individual Performance Measures

Individual Performance Measure - Flight Operations Coordinator (FOC)

Team _____ Semester *Fall 2017* 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.

Never Sometimes Always

1 2 3 4 5 6 7

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 - Crew Scheduling (CS)

Team _____ Semester *Fall 2017* SIM (Circle) 1 2 3 Date_____
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.

Never ***Sometimes*** ***Always***

1 2 3 4 5 6 7

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. _____ **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.)

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

Team _____ Semester *Fall 2017* SIM (Circle) 1 2 3 Date of SIM_____

Rater_____

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

Never ***Sometimes*** ***Always***

1 2 3 4 5 6 7

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 - Ramp Tower Coordinator (Ramp)

Team _____ Semester *Fall 2017* 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.

Never ***Sometimes*** ***Always***

1 2 3 4 5 6 7

1. _____ Effectively manages arrival planes.
2. _____ Keeps track of the status of planes awaiting departure.
3. _____ When necessary, redirects airplanes effectively.
4. _____ Is aware of issues preventing release of the aircraft.
5. _____ Maintains efficiency even in hectic periods.
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

Collective Efficacy Measure

The following questions ask about your perceptions of your team's expected overall performance in the FOCUS Lab simulation exercise. Please respond to each question using the scale below. Please answer openly and honestly, there are no right or wrong answers.

ITEMS		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I feel confident in my team's ability to perform the simulation.	1	2	3	4	5
2.	I think my team can eventually reach a high level of performance on the simulation.	1	2	3	4	5
3.	I am sure my team can learn how to perform this simulation effectively in a relatively short period of time.	1	2	3	4	5
4.	I don't feel that my team is as capable of performing the simulation.*	1	2	3	4	5
5.	On the average, other teams are probably much more capable of performing this simulation than my team.*	1	2	3	4	5
6.	My team will learn the simulation quickly, in comparison to other teams.	1	2	3	4	5
7.	I am not sure my team can ever reach a high level of performance on this simulation, no matter how much practice and training we get.*	1	2	3	4	5
8.	It would take my team a long time to learn how to perform this simulation effectively.*	1	2	3	4	5
9.	I am not confident that my team can perform this task effectively.*	1	2	3	4	5
10.	I doubt that my team's performance will be very adequate on the simulation.*	1	2	3	4	5

*** Reverse scored item**

APPENDIX F

Trigger Response Effectiveness Measure

Team _____ _____ SIM (Circle) 1 2 3

Date of SIM_____ Rater_____ Present at SIM (Circle) Yes

Embedded Crew Scheduling – Effectiveness						
Effectiveness of response to crew scheduling triggers is measured by the number of illegal flights caused by not effectively swapping out crews, communication of the crew scheduler with other key positions, and whether or not they used our aircraft when changing crews.						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Did not effectively swap crews to avoid illegal flights AND/OR - Unnecessarily deadheading crew AND/OR - No communication with rest of key positions		- 2 illegal flights AND/OR - Did not swap early at hub locations for most crew busts - Communication with FOD2 and/or FOC - Caused flight delays - Used other airlines' flights unnecessarily more than 50% of the time		- 1 illegal flight AND/OR - Proactively swapped early at hub locations for most crew busts - Communication with FOD2 and FOC as needed - Proactive to minimize flight delays - Used other airlines' flights unnecessarily less than 50% of the time		- No illegal flights AND/OR - Proactively swapped early at hub locations for all crew busts - Proactively minimized all flight delays - Communication with both FOD2 and FOC - When possible, used our flights rather than other airlines' flights

No

Embedded Weather – Effectiveness						
Effectiveness of response for weather triggers is measured by the number of people in key positions that they communicated weather issues and solutions with (e.g. FOD2, FOC) and whether or not appropriate actions were taken to resolve the trigger (e.g. additional fuel, diversion, legal alternatives)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Did not give briefing or communicate with other key positions - Allowed planes to fly through severe weather (e.g. severe thunderstorms, winds, icing) - Did not add additional fuel for alternates, alternate routes, or winds aloft		- Communication with 1 key position (e.g. FOC, pilot, maintenance) - Usually chose safe routes, but not always the best route, and ensured the correct addition of fuel for alternates and winds aloft for 25% of the affected flights		- Communication with 1-2 key positions (e.g. FOC, pilot, maintenance) - Chose safe routes that were also usually the best route, and ensured the correct addition of fuel for alternates and winds aloft for 75% of the affected flights		- Full weather briefing to team, including pilots off-site - Chose the best routes and ensured the correct addition of fuel for alternates and winds aloft for ALL affected flights

Embedded FOD2 – Effectiveness						
Effectiveness of Response to FOD2 triggers is measured by the number of illegal flights because they were overweight, the percentage of cargo that the FOD2 handled, and/or the use of their own airline flights rather than other airlines when moving cargo from overweight planes.						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- All embedded weight issues led to illegal flights - Never removed cargo from overweight flights - Did not communicate with key positions		- 2-3 illegal flights - Sometimes removed the correct amount of cargo from overweight flights - Handled less than 25% of cargo AND/OR - Frequently used other airlines when it could have been avoided - Communicated with 1 key position as needed (e.g. FOC or WX)		- 1 illegal flight - Usually removed the correct amount of cargo from overweight flights - Handled 75% of cargo AND/OR - Rarely used other airlines/ used our planes whenever possible		- No illegal flights - Removed the correct amount of cargo from all overweight flights 100% of the time - Handled/rerouted 100% of cargo - Used our planes whenever possible - Communicated with all key positions as needed

Embedded Maintenance – Effectiveness						
Effectiveness of response for maintenance triggers is measured by the number of people in key positions that they communicate with, whether or not maintenance issues were addressed at a hub location when possible, whether or not maintenance problems caused delays, and if they used contract maintenance appropriately or not.						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Did not communicate with rest of team - Did not properly follow MEL guidelines/restrictions - Did not handle issues/make repairs before flying - Caused downstream consequences (e.g. significant delays)		- Chose to complete maintenance at non-hub, when it could have been postponed and completed at hub AND/OR - Used contract maintenance unnecessarily/did not call in time - Scheduled maintenance in a fashion that caused some delays		- Took care of 75% of problems, even if not the most effective solutions - Communicated with 2 key positions - Properly utilized the MEL guidelines/restrictions with 0-1 errors - Chose to complete maintenance at non-hub, when it could have been postponed and completed at hub AND/OR - Used contract maintenance unnecessarily/did not call in time		- Efficiently took care of 100% of problems - Communicated with all key positions - Fixed all issues before flying at appropriate times - Properly utilized the MEL guidelines/restrictions - Completed maintenance repairs at a hub whenever possible - Scheduled all maintenance in a fashion that did not cause significant delays

All Wiffleballs (passenger heart attack, peanut allergy, unruly passenger)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Ignored the Pseudo Pilot's notice of the on-board emergency - Didn't call for support services (e.g. EMT or Law Enforcement Personnel) - Didn't resolve any downstream consequences (e.g. refueling, missed connections, future leg delays) - Left passengers on the aircraft for more than 1.5 hours		- Arranged for support services, but took no further action - Didn't re-release plane to continue the flight - Didn't resolve any downstream consequences (e.g. refueling, missed connections, future leg delays) - Left passengers on the aircraft for more than 1.5 hours		- Arranged for support services - Recalculated fuel and refueled as necessary - Re-released plane to continue the flight - Completed in an untimely manner - Didn't address downstream consequences (e.g. missed connections, future leg delays)		- Arranged for support services - Recalculated fuel and refueled as necessary - Re-released plane to continue the flight - Completed in a timely manner, which prevented any downstream consequences

Difficulty to Solve

1	2	3	4	5	6	7
Extremely Easy						Extremely Difficult

Maintenance (engine oil leak, flaps won't operate, and cargo door won't close)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Released plane without fixing the maintenance issue - Left plane on the ground (either fixed the issue or did not) - Didn't resolve any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours		- Flew Universal E-Line's maintenance personnel down to fix the issue that caused a significant time delay and wasted resources - Released flight once the maintenance issue was fixed, but not immediately - Didn't resolve any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours		- Called contract maintenance, but not in a timely manner - Released flight once the maintenance issue was fixed, but not immediately - Resolved less than 50% of the missed connections - Didn't get a spare plane and reserve crew at the destination to continue later legs		- Called contract maintenance in a timely manner (less than 15 minutes) - Released flight immediately after the maintenance issue was fixed - Resolved more than 75% of the missed connections - Got a spare plane and reserve crew at the destination to continue later legs without any future delays.

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

Runways (Suspicious package in terminal, ATC fire, and security airport closure)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Released plane before the airport/terminals were re-opened or ATC fire issue resolved, or at least attempted to do so - Didn't address any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours -Did not divert flights to the nearest approved airports and allowed flights to land at the intended destination		- Never released flights from their diversion or departure airports, even after the airport/terminals were re-opened or ATC fire issue resolved - Didn't address any downstream consequences (e.g. missed connections, future leg delays) - Less than 25% of inbound planes were diverted to the nearest approved airports or held from taking off - Left passengers on plane for more than 1.5 hours		- Poor communication with Pseudo Pilot/Administrator regarding the resolution of the issue (needed to be prompted about diverting/releasing flights) - 25- 75% of inbound planes were diverted to the nearest approved airports or held from taking off - Did not complete fuel calculations AND communicate with crew scheduling prior to the airport/terminal reopening or the ATC fire issue being resolved, leading to a delay in releasing the plane - Resolved less than 50% of the missed connections		Communicated regularly with Pseudo Pilot/Administrator to see when issue is resolved - More than 75% of inbound planes were diverted to the nearest approved airports or held from taking off - Completed both the fuel calculations AND communicated with crew scheduling prior to the airport/terminal reopening or the ATC fire issue being resolved, preventing further delays - Resolved more than 75% of the missed connections

Runways (Suspicious package in terminal, ATC fire, and security airport closure)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
				- Didn't get a spare plane and crew at the destination to continue later legs		- Got a spare plane and reserve crew at the destination to continue later legs without any future delays.

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

Crew Scheduler Issue (Captain broken arm, Drunk FO, Sick Pilot, Pilot Fatigue)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Didn't call for a reserve crew to take over the flight (no action) - Released flight with the original crew - Didn't address any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours		- Called for a reserve crew - Arranged for a flight to transport the reserve crew to the location of the original crew in an inefficient and costly method (e.g. chartered a plane, ground transportation, etc.) - Released flight after the reserve crew arrived, but not immediately - Didn't address any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours		- Called for a reserve crew - Arranged for a flight to transport the reserve crew to the location of the original crew, but <u>not on the soonest flight</u> - Released flight after the reserve crew arrived, but not immediately - Resolved less than 50% of the missed connections - Didn't get a spare plane and reserve crew at the destination to continue later legs		- Called for a reserve crew - Held the soonest hub flight, in order to transport the reserve crew to the location of the original crew (bumped passengers if needed) - Released the flight immediately after the reserve crew arrived - Resolved more than 75% of the missed connections - <u>Got a spare plane and reserve crew</u> at the destination to continue later legs without any future delays.

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

In-Flight Maintenance (Rapid decompression, Bird strike, Landing Gear won't retract)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Did NOT divert plane upon receiving the Pseudo Pilot's notice of problem - Diverted but didn't resolve any downstream consequences (e.g. stranded passengers, missed connections, future leg delays) - Left passengers on the aircraft for more than 1.5 hours		- Diverted plane upon receiving the Pseudo Pilot's notice of problem - Called contract maintenance - Bussed passengers (or obtained other inefficient mode of travel) to their next destination - Didn't resolve any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on the aircraft for more than 1.5 hours		- Diverted plane upon receiving the Pseudo Pilot's notice of problem - Used Universal Elines resources and obtained a crew, MX personnel, necessary parts/equipment, and a spare aircraft to pick up passengers and complete remaining legs. There was a delay in this process. - Resolved less than 50% of the missed connections -Contacted emergency services to meet the plan after it lands (as needed)		- Diverted plane upon receiving the Pseudo Pilot's notice of problem - Used Universal Elines resources and obtained a crew, MX personnel, necessary parts/equipment, and a spare aircraft to pick up passengers and complete remaining legs. This was done in a timely manner. - Resolved more than 75% of the missed connections -Contacted emergency services to meet the plan after it lands (as needed)

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

Weather-Related Maintenance (Wing anti-ice valve inop and weather radar inop)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Weather and Maintenance positions did not communicate - Released plane without fixing the maintenance issue (weather required a fix) - Left plane on the ground (either fixed the issue or did not) - Didn't resolve any downstream consequences (e.g. missed connections, future leg delays) - Left passengers on plane for more than 1.5 hours		-Weather and Maintenance positions did not communicate - Released plane with or without fixing the maintenance issue (and weather did NOT require a fix) - Flew Universal E-Line's maintenance personnel down to fix the issue that caused a significant time delay and wasted resources - Released flight once the maintenance issue was fixed, but not immediately		-Weather and Maintenance positions communicated - Called contract maintenance, but not in a timely manner (weather required a fix) OR released flight because weather did not require a fix - Released flight once the maintenance issue was fixed, but not immediately - Resolved less than 50% of the missed connections - Didn't get a spare plane and reserve crew at the destination to continue later legs		-Weather and Maintenance positions communicated - Called contract maintenance in a timely manner (less than 15 minutes – weather required a fix) OR released flight because weather did not require a fix - Released flight immediately after the maintenance issue was fixed - Resolved more than 75% of the missed connections .

Weather-Related Maintenance (Wing anti-ice valve inop and weather radar inop)						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
		- Didn't resolve any downstream consequences (e.g. missed connections, future leg delays)				- Got a spare plane and reserve crew at the destination to continue later legs without any future delays

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

Leftover Cargo						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Handled none of the cargo - Did not communicate with key positions		- Handled less than 25% of cargo - Frequently used other airlines when it could have been avoided - Communicated with 1 key position as needed (e.g. FOC)		- Handled 75% of cargo - Rarely used other airlines/ used our planes whenever possible		- Handled/rerouted 100% of cargo - Used our planes whenever possible - Communicated with all key positions as needed

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult

Leftover Passengers						
1 Extremely Ineffective	2	3	4	5	6	7 Extremely Effective
- Handled none of the passengers - Did not communicate with key positions		- Handled less than 25% of passengers - Frequently used other airlines when it could have been avoided - Communicated with 1 key position as needed (e.g. FOC)		- Handled 75% of passengers - Rarely used other airlines/ used our planes whenever possible		- Handled/rerouted 100% of passengers - Used our planes whenever possible - Communicated with all key positions as needed

Difficulty to Solve

1 2 3 4 5 6 7

Extremely Easy Extremely Difficult