Introduction

- This research was conducted at the Flight Operations Center Simulation (FOCUS) Lab where aerospace students from various disciplines (flight dispatch, technology, maintenance management, professional pilot, and airport administration) participate in three high-fidelity flight simulations that are each followed by team debriefings (i.e., After Action Reviews - AARs).
- Students are asked to treat the simulations as if it was their real job and their goal is to reach high levels of safety, efficiency, teamwork, and individual task performance while bringing profit to an airline.
- Within the FOCUS Lab, there are nine individual roles that represent the main functions of today’s dispatching teams at flight operations centers. The positions include: Flight Operations Coordinator, Crew Scheduling, Maintenance Control, Weather Operations, Flight Scheduling, Flight Planning, Ramp Tower Coordinator, Pseudo Pilot, and Pilot.
- Because there was no measure of performance that emphasized individual level contributions (taskwork) at the FOCUS lab, such measures were developed and validated for purposes of this study. We validated the measures by providing evidence of their reliability, as well as other substantive findings that would provide evidence for their construct validity.
- Because the essence of individual (taskwork) is central for teams to be effective in a complex environment (Krokos, Backer, Alonso, & Day, 2009), we hypothesized that individual performance measures are positively related to teamwork as well as team performance.
- Little research exists on transition phase process (processes that take place before and after a mission/simulation - AAR), so we investigated how individual performance relates to team debriefings after the FOCUS Lab via a research question (Marks, Mathieu, & Zaccaro, 2001).

Hypothesis 1: The average score for individual performance will be positively related to teamwork performance across all flight simulations. (Krokos, Backer, Alonso, & Day, 2009)

Hypothesis 2: The average score for individual performance will be positively related to the team performance across all flight simulations.

Research Question 3: The average score for individual performance on a prior flight simulation will be positively related to the following team’s transition performance across all flight simulations.

Individual Performance Measures: A measure that assessed the frequency of specific job relevant behaviors expected from each position (Behavioral Observation Scales). It was developed for nine position. Following each flight simulation, individual performance measures for each position, were filled out by two or three members of the FOCUS Lab staff who were assigned to observe their specific position based upon their unique areas of expertise.

Teamwork Performance Measures:
1) Action Phase: Teamwork Performance: A self-report measure used to assess teamwork performance during the simulation. This measure contains four sub-dimensions: monitoring progress toward goals, systems monitoring, team monitoring and backup responses, and coordination activities (Marks, Mathieu, & Zaccaro, 2001). Following each flight simulation, participants completed the measure via an electronic survey.
2) Interpersonal Teamwork Performance: A self-report measure used to assess participants’ perception of their team’s interpersonal processes. This measure contains four sub-dimensions: conflict management, motivating and motivating confidence, and affect management (Marks, Mathieu, & Zaccaro, 2001). Following each flight simulation, participants completed the measure via an electronic survey.
3) Teamwork Grading Rubric: A measure used to evaluate teams’ level of teamwork during a simulation. This measure contains three sub-dimensions: problem solving, information utilization, and coordination. Following each simulation, FOCUS Lab staff who observed the flight simulation completed this measure.

Team Performance Measures:
1) Financial Revenue: A measure of quantified revenue generated teams after each flight simulation. The revenue is mostly influenced by the total amount of time due to flight delays, and each minute of delay can be translated into a dollar amount. Following each simulation, team performance metrics were collected and recorded.
2) Trigger Response Effectiveness: The trigger response effectiveness measure targets a specific situation that was defined to have a critical significance to team outcomes by the staff of the lab. After issue has been identified, lab’s faculty discuss what would be the optimal response to this situation, and compared it to the response exhibited by the team. Following this discussion, which occurs after each flight simulation has ended, the trigger response effectiveness measure is filled out by the FOCUS lab observers that were present during the flight simulation.

Transition Performance Measure: A self-report and observer measure that is used to evaluate the quality of processes that occurred during the After Action Review. This measure contains three main sub-dimensions: mission analysis, goal specification, strategy formulation, as well as learning occurred (Marks, Mathieu, & Zaccaro, 2001). Following each flight simulation, student-participants as well as the facilitator of the After Action Review completed this measure.

Research Design:

Methods

Aerospace students enrolled in AERO 4040 were assigned into six teams with nine or ten students in each team. Each of the six teams participated in three flight simulations throughout the semester. Six to ten members of the FOCUS Lab staff observed each simulation to rate teamwork as well as individual performance. Each one of the three simulations was followed by an After Action Review (AAR), which is a facilitated discussion of positive and negative events and opportunities for improvement. Data in this study was analyzed at the team level. To test Hypothesis 1 & 2, and the Research Question, average scores for all nine individual performance measures during flight simulation one, two, and three were computed and then correlated to the subsequent teamwork, team, and transition performance measures in their respective flight simulations and then averaged across all three flight simulations (illustration below).

Hypothesis 1

Hypothesis 2

Discussion

- Findings of this study suggest that individual performance measures are valid and are related with teamwork, team, and transition performance as it was expected.
- Because there were up to three raters that assessed performance of individual roles at the NASA FOCUS Lab, inter-rater reliability of the individual performance measures were assessed by providing correlations between raters for each positions. It was found that inter-rater reliability was very high for some positions (Crew Scheduling r = .773, Maintenance Operations r = .798, Flight Operations Coordinator r = .640, and Weather Operations r = .624) modest for other positions (Pseudo Pilot r = .433, Ramp Tower Operations r = .472, and Pseudo Pilot r = .433), and very low for the flight planning r (position r = .117). On average inter-rater reliability estimates for the individual performance measure were r = .492, which is representative of the fact that for the most part individual performance measures are reliable, and that for most positions there was moderate to strong agreement among raters.
- The teamwork patterns discussed in this study are essential in today’s dynamic environment, especially in highly interdependent work-teams that exist in today’s aerospace, fire-fighting, medical, and military units, and many other industries and/or domains. Findings of this research can contribute to other of those that examined effectiveness of team debriefings (i.e., transition performance) and shown its positive relationship with teamwork/individual performance effectiveness (Tannenbaum & Cerasoli, 2012).

Limitations

- Because there are a limited number of people who possess skills that are to run NASA FOCUS Lab, we could only recruit a restricted number of participants for this study. Due to this, results of the correlations examined in this study are based on a small number of teams (six teams total: df = 5), and since all correlations are based at team level, they may provide weak statistical power while answering most hypotheses and research questions.
- We would like to note that this is only an exploratory study, and we would suggest that results of its correlational findings are to be interpreted in terms of the magnitude of their r values, opposite to paying attention to significance (which was not reported).
- Finally, it is important to interpret the findings of this study with caution. One should only try seeking an overall understanding of a correlations pattern (i.e., associations), instead of making causal judgments in answering the following hypotheses.

Related Work