Assessing the Impact of Text-Based Communications on Team Performance in a Flight Operations Center Simulation
Presentation Overview

- Brief Review of Literature
- Statement of the Problem with Research Questions
- Methodology
  - Overview of NASA Focus Lab
- Data Analysis & Results
- Study Limitations & Recommendations
Review of Literature

Verbal vs. Textual Communication

• Yale & Michigan State (’98)

• University of Florida & Michigan State (2002)

• Wayne State University Meta Analysis (2008)
Statement of the Problem

• Impacts of verbal/textual communications on team performance remains unclear

• Computer-assisted communication already exist in the aviation industry
  • Flight Ops Centers
  • ACARS (Aircraft Communications Addressing and Reporting System)
Research Questions

1. Is there a significant difference in on-time performance between teams who utilize text-based communications and verbal communications and teams who utilize only verbal communications?

2. How effective do airline operations center participants perceive the different communication methods to be?

3. In what ways, or in which circumstances in an airline operations center do participants feel that text-based communication is more beneficial than verbal communication?

4. How can verbal communications in an airline operations center be improved?

5. Does an increase in text-based communications correlate to an increase in a team’s on-time performance?
Methodology

QUANTITATIVE & QUALITATIVE VIA FOCUS LAB
Overview of the NASA FOCUS Lab

FOCUS

• Flight
• Operations
• Center
• Unified
• Simulation

PURPOSE:

• Teamwork Skill Enhancement
• Achieve Operational Goals
  • Part 121 Regional Ops Center
• Increases ‘Big Picture’ understanding
  • 10 year estimate
NASA FOCUS Lab Layout
Participants & Study Design

• 65 students in AERO 4040 – Spring 2015
  • IRB approval & consent forms obtained

• Students divided into 6 teams
  • 3 teams allowed to communicate verbally and textually
  • 3 teams allowed to communicate only verbally

• Recorded data from 18 simulations
  • On-time performance financials
  • Skype text-messages
Survey Instruments

• (R2) Five Point Likert Scale Questionnaires
• (R3 & R4) Open-ended Questionnaires

50 out of 65 students completed assigned surveys
• 133 total surveys completed
• 77% completion rate
Data Analysis & Results

RESEARCH QUESTIONS 1-5
(R1): Is there a significant difference in on-time performance between teams who utilize text-based communications and verbal communications and teams who utilize only verbal communications?

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal</td>
<td>9</td>
<td>$25225.75</td>
<td>8149.85</td>
<td>2716.61</td>
</tr>
<tr>
<td>Textual/Verbal</td>
<td>9</td>
<td>$31576.73</td>
<td>26736.45</td>
<td>8912.15</td>
</tr>
</tbody>
</table>

Note. OTP=On-time Performance

2-Tailed Independent Samples T-Test

<table>
<thead>
<tr>
<th></th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTP</td>
<td>-.682</td>
<td>16</td>
<td>.505</td>
<td>-6350.97444</td>
<td>9316.99952</td>
<td>-26102.13111, 13400.18222</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPC</td>
<td>-.682</td>
<td>9.474</td>
<td>.512</td>
<td>-6350.97444</td>
<td>9316.99952</td>
<td>-27267.85950, 14565.91061</td>
</tr>
</tbody>
</table>

\[ t(16) = -0.682 \quad p = 0.505 \]

No Significance
(R2): How effective do airline operations center participants perceive the different communication methods to be?

Frequency Analysis for Groups 1-3: Verbal Communication Only

<table>
<thead>
<tr>
<th></th>
<th>Q1 Having only verbal comms increases effectiveness</th>
<th>Q2 Having only verbal comms decreases effectiveness</th>
<th>Q3 Having the option to text would increase comms effectiveness</th>
<th>Q4 Using only verbal is most effective means of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
</tr>
<tr>
<td>SD</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>11</td>
<td>47.8</td>
<td>5</td>
<td>21.7</td>
</tr>
<tr>
<td>N</td>
<td>6</td>
<td>26.1</td>
<td>4</td>
<td>17.4</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>17.4</td>
<td>9</td>
<td>39.1</td>
</tr>
<tr>
<td>SA</td>
<td>2</td>
<td>8.7</td>
<td>2</td>
<td>8.7</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>100.0</td>
<td>23</td>
<td>100.0</td>
</tr>
</tbody>
</table>
(R2): How effective do airline operations center participants perceive the different communication methods to be?

**Frequency Analysis for Groups 4-6: Text & Verbal Communication**

<table>
<thead>
<tr>
<th></th>
<th>Q1 Textual comms are most effective</th>
<th>Q2 Verbal comms are most effective</th>
<th>Q3 50/50 mix of comms are most effective</th>
<th>Q4 Using only textual comms is most effective</th>
<th>Q5 Using only verbal comms is most effective</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
<td>SD</td>
<td>3</td>
<td>11.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>7</td>
<td>25.9</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>37.0</td>
<td>3</td>
<td>11.1</td>
<td>6</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>18.5</td>
<td>12</td>
<td>44.4</td>
<td>14</td>
</tr>
<tr>
<td>SA</td>
<td>2</td>
<td>7.4</td>
<td>12</td>
<td>44.4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100.0</td>
<td>27</td>
<td>100.0</td>
<td>27</td>
</tr>
</tbody>
</table>
(R3): In what ways, or in which circumstances in an airline operations center do participants feel that text-based communication is more beneficial than verbal communication?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>texts are more concise/provides additional clarity</td>
<td>12</td>
<td>32.4</td>
<td>32.4</td>
<td>32.4</td>
</tr>
<tr>
<td>generates a referenceable communication trail</td>
<td>6</td>
<td>16.2</td>
<td>16.2</td>
<td>48.6</td>
</tr>
<tr>
<td>not more beneficial</td>
<td>4</td>
<td>10.8</td>
<td>10.8</td>
<td>59.5</td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>10.8</td>
<td>10.8</td>
<td>70.3</td>
</tr>
<tr>
<td>relaying complex/information rich messages</td>
<td>3</td>
<td>8.1</td>
<td>8.1</td>
<td>78.4</td>
</tr>
<tr>
<td>during high workload periods</td>
<td>2</td>
<td>5.4</td>
<td>5.4</td>
<td>83.8</td>
</tr>
<tr>
<td>faster information relay</td>
<td>2</td>
<td>5.4</td>
<td>5.4</td>
<td>89.2</td>
</tr>
<tr>
<td>fewer interruptions</td>
<td>2</td>
<td>5.4</td>
<td>5.4</td>
<td>94.6</td>
</tr>
<tr>
<td>provides for more time for effective decision making</td>
<td>1</td>
<td>2.7</td>
<td>2.7</td>
<td>97.3</td>
</tr>
<tr>
<td>aids in workplace noise reduction</td>
<td>1</td>
<td>2.7</td>
<td>2.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
**R3:** In what ways, or in which circumstances in an airline operations center do participants feel that text-based communication is more beneficial than verbal communication?

Provide an example of when text-based communication proved to be more effective than verbal communication.

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>other</td>
<td>8</td>
<td>26.7</td>
<td>26.7</td>
<td>26.7</td>
</tr>
<tr>
<td>generates a referenceable communication trail</td>
<td>6</td>
<td>20.0</td>
<td>20.0</td>
<td>46.7</td>
</tr>
<tr>
<td>communicating with someone in a different location</td>
<td>5</td>
<td>16.7</td>
<td>16.7</td>
<td>63.3</td>
</tr>
<tr>
<td>referencing a flight # or list of flight #s</td>
<td>4</td>
<td>13.3</td>
<td>13.3</td>
<td>76.7</td>
</tr>
<tr>
<td>provides for more time for effective decision making</td>
<td>2</td>
<td>6.7</td>
<td>6.7</td>
<td>83.3</td>
</tr>
<tr>
<td>relaying complex/information rich messages</td>
<td>2</td>
<td>6.7</td>
<td>6.7</td>
<td>90.0</td>
</tr>
<tr>
<td>aids in workplace noise reduction</td>
<td>2</td>
<td>6.7</td>
<td>6.7</td>
<td>96.7</td>
</tr>
<tr>
<td>not more beneficial</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
(R4): How can verbal communications in an airline operations center be improved?

What can be done to improve verbal communications in an airline operations center such as the FOCUS Lab?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>streamlined headset use and functionality</td>
<td>12</td>
<td>20.0</td>
<td>20.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Properly Functioning Equipment</td>
<td>11</td>
<td>18.3</td>
<td>18.3</td>
<td>38.3</td>
</tr>
<tr>
<td>Concise tone/common language/etiquette</td>
<td>8</td>
<td>13.3</td>
<td>13.3</td>
<td>51.7</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>10.0</td>
<td>10.0</td>
<td>61.7</td>
</tr>
<tr>
<td>location/positioning/ close proximity</td>
<td>5</td>
<td>8.3</td>
<td>8.3</td>
<td>70.0</td>
</tr>
<tr>
<td>following SOPs</td>
<td>4</td>
<td>6.7</td>
<td>6.7</td>
<td>76.7</td>
</tr>
<tr>
<td>nothing</td>
<td>4</td>
<td>6.7</td>
<td>6.7</td>
<td>83.3</td>
</tr>
<tr>
<td>minimize excessive chat</td>
<td>3</td>
<td>5.0</td>
<td>5.0</td>
<td>88.3</td>
</tr>
<tr>
<td>Additional training</td>
<td>3</td>
<td>5.0</td>
<td>5.0</td>
<td>93.3</td>
</tr>
<tr>
<td>familiarity with personnel</td>
<td>2</td>
<td>3.3</td>
<td>3.3</td>
<td>96.7</td>
</tr>
<tr>
<td>additional employees</td>
<td>1</td>
<td>1.7</td>
<td>1.7</td>
<td>98.3</td>
</tr>
<tr>
<td>Screen share</td>
<td>1</td>
<td>1.7</td>
<td>1.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td><strong>100.0</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>
(R5): Does an increase in text-based communications correlate to an increase in a team’s on-time performance?
(R5): Does an increase in text-based communications correlate to an increase in a team’s on-time performance?

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>30532.60</td>
<td>14009.21</td>
<td>2.18</td>
<td>.07</td>
</tr>
<tr>
<td>Texts</td>
<td>7.03</td>
<td>69.18</td>
<td>.04</td>
<td>.10</td>
</tr>
</tbody>
</table>

a. Dependent Variable: OTP

Significance: p = 0.922 >.05
Limitations of Research

• Small sample size
  • 65 participants / 6 teams

• Inability to completely isolate variables

• Restrictive language in Likert Scale surveys
Recommendations for Future Research

• Increase sample size

• Completely isolate variables

• Evaluate against different performance metrics

• Assess impact of the quality, not quantity, of textual communications on team performance