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Effects of Graphical Weather Information versus Textual Weather Information on Situation Awareness in Meteorology

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EFFECTS OF GRAPHICAL WEATHER INFORMATION VERSUS TEXTUAL WEATHER INFORMATION ON SITUATION AWARENESS IN METEOROLOGY

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Introduction
Introduction

- Before a flight, pilots gather weather information
  - Self-briefing and/or professional weather briefer (Casner, Murphy, Neville, & Neville, 2012)
- Aviationweather.gov provides weather products in graphical and text form
  - Pilots need to interpret symbols and abbreviations
  - Would one type be better than the other?
- Kharb, Samanta, Jindal, and Singh (2013) found that people prefer visual to verbal learning
  - Could this have an effect on the way we look at weather information?
Review of Relevant Literature
Situation Awareness

- **Definition**
- **Factors for SA:**
  - Weather conditions
  - Traffic
  - Flight conditions
  - Locations for potential emergency landings
  - Navigation aids, etc.
- This study focused on the meteorological aspect of SA, or, Situation Awareness in Meteorology (SAM)
Importance of conducting research on SAM

- Continued VFR (Visual Flight Rules) flight into IMC (instrument meteorological conditions) is one leading causes of fatal accidents in the general aviation industry.
  - This accounted for 27% of fatalities in general aviation accidents. (AOPA, 1996)

- Weather-related mishaps have the highest fatality rate of any kind (AOPA, 2009)

- The NTSB mentioned “Identifying and Communicating Hazardous Weather” in their 2014 Most Wanted List.
Previous Research

- A study showed that VFR flight into IMC conditions primarily involved inexperienced pilots. (Detwiler, Holcomb, Boquet, Wiegmann, & Shappell, 2005)

- The way people learn varies from person to person.
  - VARK Model (Fleming & Mills, 1992)
  - Study showed that 61% of medical students had multimodal preferences (Kharb, Samanta, Jindal, & Singh, 2013).
Endsley (1995) found that 88% of major airline accidents involved problems with lack of SA.

Some pilots brief themselves on weather rather than contacting a professional weather briefer. (Casner, Murphy, Neville, & Neville, 2012).
Methodology
GWI and TWI

KRUT 150256Z 15010G25KT 6SM -SN OVC030 M03/M06 A2968
KLEB 080235Z 36000G15KT 9SM OVC023 M04/M08 A2978
KGFL 080253Z 00000KT 3SM -FZRA BKN014 01/M01 A2964
KALB 080251Z 16005KT 10SM OVC018 01/M01 A2965
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KPOU 080253Z 27005KT 1 3/4SM OVC008 00/M01 A2968
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KBTV 080254Z 18010G20KT 10SM -FZRA OVC035 M01/M03 A2958
KSLK 080251Z 19005KT 10SM UP OVC022 02/M01 A2939
Participants

- 20 Participants
  - SONA Systems recruitment
  - E-mails (ETA messages)
  - Posted flyers
Materials

- TWI and GWI
- CERTS Lab
- Advanced flight simulator running FSX
- Modified version of SPAM to assess participants’ SAM
- Headset with Audacity
- Questionnaires and Forms

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<tr>
<th>Textual Weather Information</th>
<th>Graphical Weather Information</th>
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<tbody>
<tr>
<td>METARS</td>
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<tr>
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<td>Wind Streamlines / Temps</td>
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Procedure

- Sign consent form
- Demographics questionnaire
- VARK questionnaire
- Practice flight
- Review weather information for flight 1 (20 minutes)
- Simulate flight 1 and answer SAM questions (20 minutes)
- Review weather information for flight 2
- Simulate flight 2 and answer SAM questions
- Debrief
Treatment of Data

- Scoring
  - Notes from flight plan to determine go/no-go decisions and hazard encounters
  - Each correct answer for a SAM question was one point. A higher score meant higher SAM.
  - Data imported to SPSS

- Analyses (SPSS)
  - Chi-square
  - T-tests
  - Correlations
Results
TWI Versus GWI on SAM

- Accuracy of SAM questions
  - GWI group answered significantly more SAM questions correctly than those in the TWI group.
  - T-test was significant, $t(19) = -2.33$, $p = 0.03$, Cohen’s $d = 0.52$
Correlations

<table>
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<th></th>
<th>GWI Score</th>
<th>Verbal Score</th>
<th>TWI Score</th>
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<tbody>
<tr>
<td>Visual Score</td>
<td>0.34</td>
<td>0.24</td>
<td>-0.46*</td>
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<tr>
<td>GWI Score</td>
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<td>0.47*</td>
<td>-0.54*</td>
</tr>
<tr>
<td>Verbal Score</td>
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<td></td>
<td>-0.15</td>
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</table>

*Correlation is significant (two-tailed)*
Discussion, Conclusions, and Recommendations
Discussion

- Go/No-Go decisions and hazard encounters
- SAM question scores
- Learning styles and SAM scores correlations
  - Using two VARK measures versus all four
  - What each VARK score represents
  - VARK Visual and TWI Score (negative)
  - VARK Verbal and GWI Score (positive)
  - TWI and GWI Score (negative)
  - Final thoughts on correlations
Conclusions and Recommendations

- Results showed GWI to be better than TWI for SAM
- Performance in flight planning

Future direction
- Further research for TWI vs GWI
- Get all important information visually?
- R&D for new products
- Test new products
- Vision for final product
Acknowledgements

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Thanks!