Aug 16th, 8:15 AM - 9:45 AM

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

Stefan Melendez M.S.A.
Embry-Riddle Aeronautical University, melendes@my.erau.edu

Andrew Dattel Ph.D.
Embry-Riddle Aeronautical University, dattela@erau.edu

Christopher Herbster Ph.D.
Embry-Riddle Aeronautical University, herbstec@erau.edu

Debbie Schaum M.A.
Embry-Riddle Aeronautical University, schaumd@erau.edu

Andrey Babin
Embry-Riddle Aeronautical University, andrey.k.babin@gmail.com

Follow this and additional works at: https://commons.erau.edu/ntas

Part of the Aviation Safety and Security Commons, and the Meteorology Commons


This Presentation is brought to you for free and open access by the Conferences at Scholarly Commons. It has been accepted for inclusion in National Training Aircraft Symposium (NTAS) by an authorized administrator of Scholarly Commons. For more information, please contact commons@erau.edu.
EFFECTS OF GRAPHICAL WEATHER INFORMATION VERSUS TEXTUAL WEATHER INFORMATION ON SITUATION AWARENESS IN METEOROLOGY

STEFAN MELENDEZ
ANDREW R. DATTEL
CHRISTOPHER HERBSTER
DEBBIE SCHAUM
ANDEY BABIN
EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
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

METAR Display valid at 0300 UTC 8 Feb 2017

Map:
- Light
- Dark
- Simple
- Satellite
- Radar

Plot Options:
- Temp
- Wind
- Alt
- Vis
- Wx
- Cover
- Cell
- Mone
- Dew
- Wgst
- Id
- Data density
- Metric
- Hover
- Scale

Data Options:
- 03 UTC 08 Mar
- Time
- Decoded
- TAF

Overlays:
- Highways
- Top Jet routes
- ARTCC/FIR Bounds

Flight Cat: MVFR • FR • LFR

KRUT 150256Z 15010G25KT 6SM -SN OVC030 M03/M06 A2968
KLEB 080235Z 36000G15KT 9SM OVC023 M04/M08 A2978
KGFL 080253Z 00000KT 5SM -FZRA BKN014 01/M01 A2964
KALB 080251Z 16005KT 10SM OVC018 01/M01 A2965
KRME 080253Z 12015KT 10SM -RA BKN021 02/01 A2950
KSYR 080254Z 15010G20KT 10SM -RA OVC075 08/06 A2938
KBGM 080253Z 16005KT 2 1/2SM OVC003 03/03 A2949
KPOU 080253Z 27005KT 1 3/4SM OVC008 00/M01 A2968
KBDL 080251Z 01008KT 10SM BKN006 00/M01 A2976
KMPV 080251Z 20010KT 2 1/2SM -SN OVC023 M07/M09 A25
KBTU 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

<table>
<thead>
<tr>
<th>Textual Weather Information</th>
<th>Graphical Weather Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>METARS</td>
<td>Graphical METARS</td>
</tr>
<tr>
<td>TAFS</td>
<td>TAFS</td>
</tr>
<tr>
<td>AIRMETS/SIGMETS</td>
<td>AIRMETS/SIGMETS</td>
</tr>
<tr>
<td>Winds/Temps Aloft Forecast</td>
<td>Wind Streamlines / Temps</td>
</tr>
<tr>
<td>Area Forecast</td>
<td>Flight Category Chart</td>
</tr>
<tr>
<td>No.</td>
<td>Flight 1</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
</tr>
<tr>
<td>1</td>
<td>KSYR - KBUF T</td>
</tr>
<tr>
<td>2</td>
<td>KSYR - KBUF T</td>
</tr>
<tr>
<td>3</td>
<td>KSYR - KBUF T</td>
</tr>
<tr>
<td>4</td>
<td>KSYR - KBUF T</td>
</tr>
<tr>
<td>5</td>
<td>KSYR - KBUF T</td>
</tr>
<tr>
<td>6</td>
<td>KSYR - KBUF G</td>
</tr>
<tr>
<td>7</td>
<td>KSYR - KBUF G</td>
</tr>
<tr>
<td>8</td>
<td>KSYR - KBUF G</td>
</tr>
<tr>
<td>9</td>
<td>KSYR - KBUF G</td>
</tr>
<tr>
<td>10</td>
<td>KSYR - KBUF G</td>
</tr>
</tbody>
</table>
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
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>
<thead>
<tr>
<th></th>
<th>GWI Score</th>
<th>Verbal Score</th>
<th>TWI Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Score</td>
<td>0.34</td>
<td>0.24</td>
<td>-0.46*</td>
</tr>
<tr>
<td>GWI Score</td>
<td></td>
<td>0.47*</td>
<td>-.54*</td>
</tr>
<tr>
<td>Verbal Score</td>
<td></td>
<td></td>
<td>-0.15</td>
</tr>
</tbody>
</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

- Dr. Alan Stolzer
- Dr. Haydee Cuevas
- Amber Davis
- Nicola O’Toole

Thanks!