# Assessing Aviation Weather Knowledge in General Aviation Pilots: Overview and Initial Results

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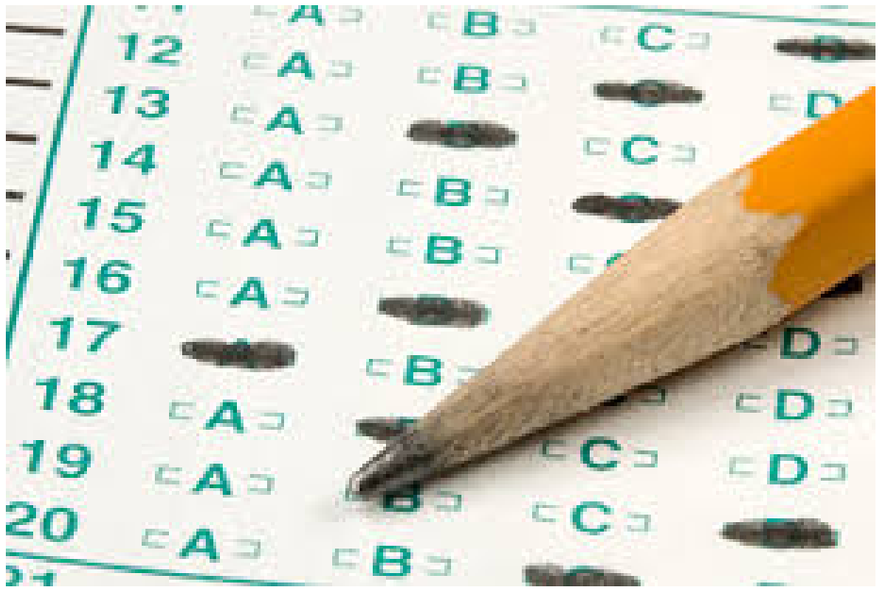
# Background

- Research indicates:
  - FAA Knowledge exams for private and commercial pilots are out of date and too easy.
  - GA Pilots may lack adequate aviation weather knowledge.
    - Are knowledge gaps a contributing factor to accident rate?
- Aviation weather knowledge assessment tools:
  - Practical use (e.g. FAA Exams → prompt better instruction)
  - Research use (e.g. to identify aviation weather training needs; validate aviation weather training strategies)

# Purpose

**Develop and validate Aviation Weather knowledge questions for use with subsequent General Aviation Weather research.**





# Knowledge questions

- 95 Aviation Weather questions ("items")
- **Team**: 2 meteorologists, 1 flight instructor, 1 I-O/HF Psychologist, 2 HF graduate students
- ***Item content:*** driven by task analysis, FAA documents, ACS codes, AFS 630 content guidelines
- ***Item format:*** driven by AFS-630 item writing guide
- ***Item level of learning:*** driven by research guidelines and AFS-630 item difficulty level guidelines (Rote, understanding, application, correlation).
- ***Content validation:*** FAA personnel

# Method

# Participants

- N = 204  (June – September 2016)
  - ERAU Affiliated  = 133; Non-ERAU  = 71
  - Part 61 = 60; Part 141/142 = 143
  - Flight hours
    - Mean = 201.4
    - Median =  131
- Pilot Certificate and/or Rating
  - Student pilots = 41
  - Private pilots = 72
  - Instrument = 50
  - Commercial = 41
- Years Flying;  Mean = 3.6

EAA AIRVENTURE OSHKOSH 2016

# Procedure

- Informed consent
- Completed Demographic information and Attitudinal measures
  - Self-efficacy (Confidence)
  - Weather salience
- Completed knowledge questions
  - Computer-based (at ERAU); Randomized
  - Paper-based (OshKosh)
- Paid $20 + $0.31 per correctly answered question (ERAU students)
- Debriefed by Experimenter (Graduate Research Assistant)

# RESULTS

# Overall Aviation Weather Knowledge Score (% Correct)

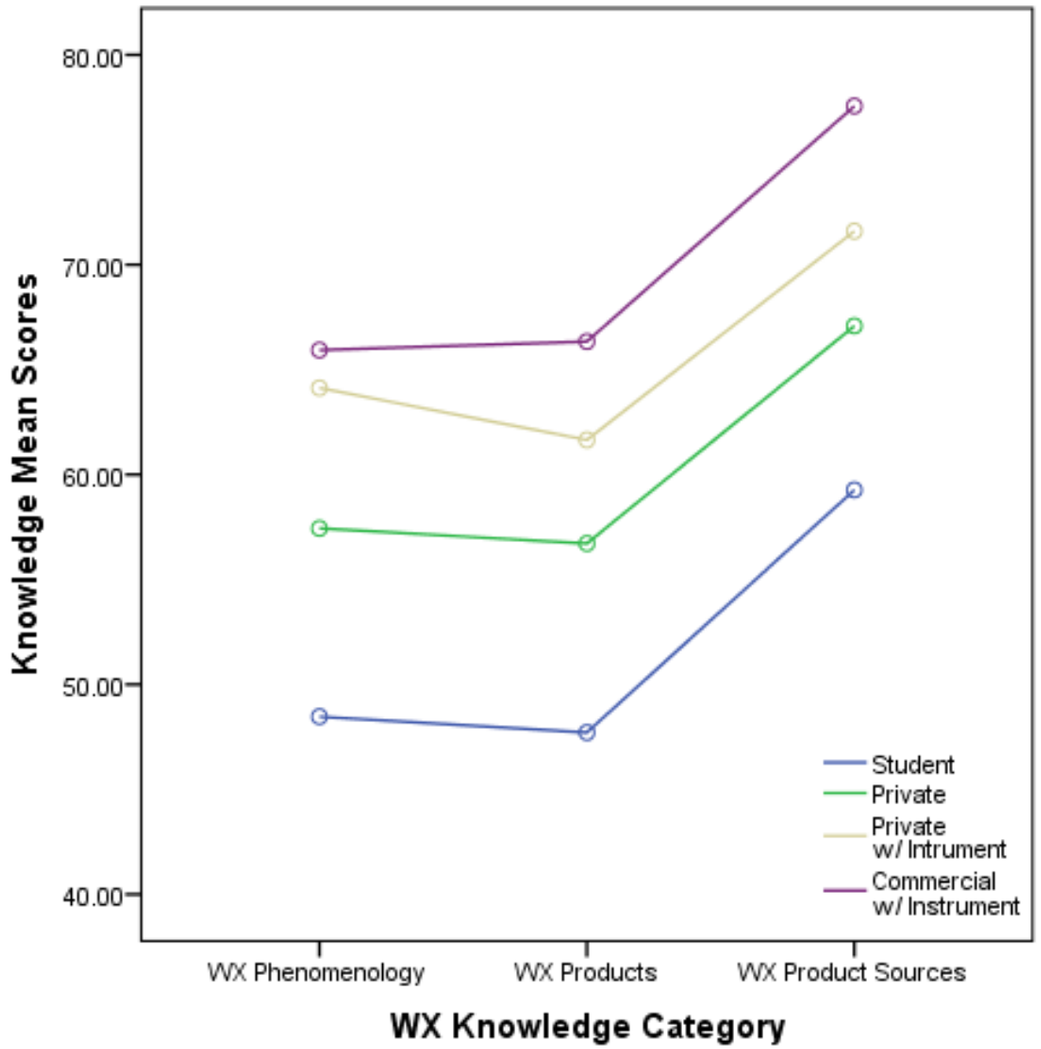
- 95 Questions (Cronbach's alpha = .92)

| | n | M (SD) |
|---|---|---|
| **Private-in-Training** | 41 | 47.65 (13.61) |
| **Private** | 72 | 56.62 (15.67) |
| **Private with Instrument** | 50 | 61.77 (12.93) |
| **Commercial with Instrument** | 41 | 65.62 (14.50) |

* One-way ANOVA Significant between groups effect

# Scores on Aviation Weather Knowledge Categories (Lanicci et al., 2011, 2016)

- Weather Phenomena
  - 31 Questions; alpha = .76
- Weather Hazard Products
  - 80 Questions; alpha = .91
- Weather Hazard Product Sources
  - 10 Questions; alpha = .66
- 3x4 Mixed ANOVA
  - 2 Significant Main effects
  - No significant Interaction effect

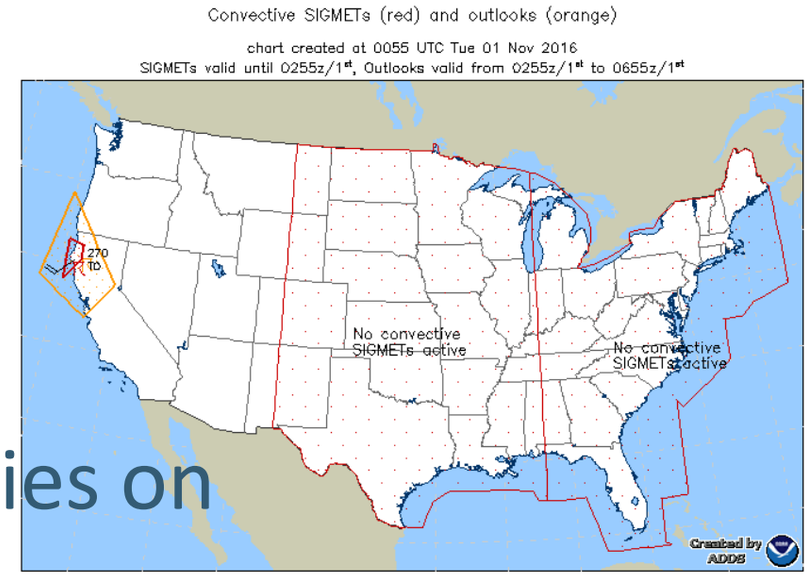


# Weather Phenomena Subcategories

- 4 x7 Mixed ANOVA
- Impact of Pilot Certificate/Rating and Weather Phenomena Subcategories on Score
- Both main effects were significant; no interaction
- Main effect for Weather Phenomena
  - Icing and Turbulence (≈ 70%)
  - Definitions of LIFR, IFR, MVFR, and VFR (≈ 65%)
  - Thunderstorms, Satellite, Radar, and Lightning concepts (≈ 60% and below)

# Weather Hazard Products Subcategories

- 4 x7 Mixed ANOVA
- Impact of Pilot Certificate/Rating and Weather Hazard Product Subcategories on Knowledge Score

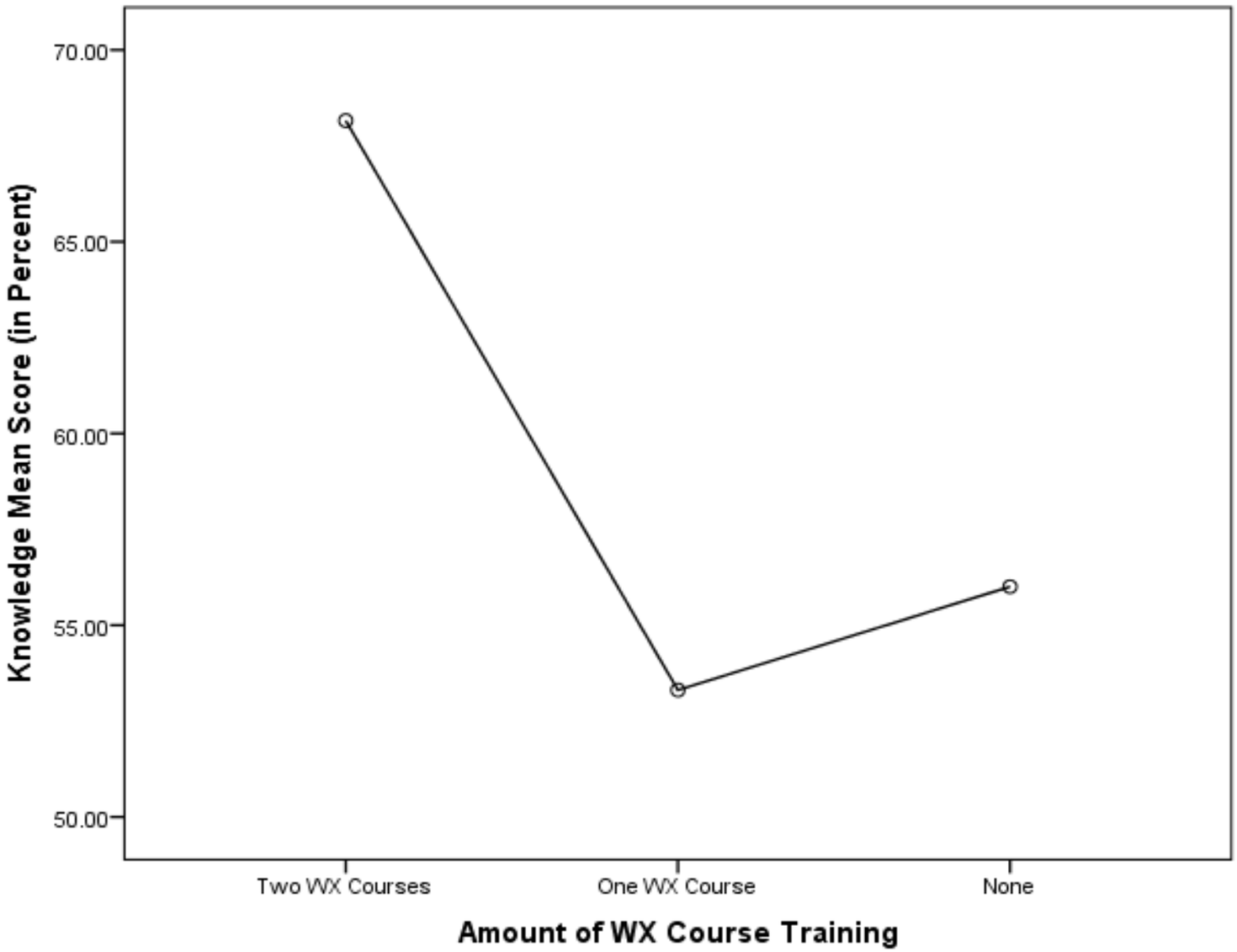



- Two significant main effects; no interaction
- Main effect for Weather Hazard Product
  - Interpreting upper level charts (≈75%)
  - Interpreting convective SIGMETs and surface charts (≈ 65 %)
  - Interpreting surface weather and PIREPS, AIRMETS, satellite data, infrared visible, water vapor, and radar (≈55%)

# Weather Product Hazard Source Subcategories

- 4 x 3 Mixed ANOVA
- Impact of Pilot Certificate/Rating and Weather Hazard Product Sources Subcategories on Knowledge Score
- Both main effects were significant; no interaction
- Main effect for Weather Hazard Product Source Subcategories
  - When to use weather product sources (≈ 72%)
  - Weather issues in Flight planning in general (≈ 70%)
  - How flight plan weather products are constructed (≈ 70%)

# Good news – Training helps!




* One-way ANOVA Significant between groups effect

# Training Experience

Estimated Months since last Weather Training

| | M (SD)<br>Median |
|---|---|
| **Private-in-Training** | 4.53 (7.81)<br>2.00 |
| **Private** | 12.55 (29.46)<br>5.50 |
| **Instrument** | 12.53 (27.51)<br>5.50 |

(Note: Private with instrument reported 8 months, and Commercial pilots reported 19+ months)

# DISCUSSION and CONCLUSION

# Discussion

- Test questions/Instrument:
  - Used a systematic approach that followed guidelines in assessment instrument development.
  - Measure has content validity and initial evidence that scores discriminate between pilots of differing levels of training.
  - Instrument generated a spread of scores reflecting both high and low aviation weather knowledge.
- GA Pilots knowledge
  - Results indicate gaps in aviation weather knowledge!
- Limitations/Future Research
  - Need to assess criterion validity of questions
  - Need older GA pilots to take the questions
- ***Current study provides an instrument that can assess GA pilot weather knowledge, and in turn, assess future Wx Training Programs.***

# Questions?