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Interpreting Aviation Weather Products: Follow-up study with AOPA Members

Faculty Researchers: Beth Blickensderfer, Ph.D. Tom Guinn, Ph.D. Bob Thomas, M.S., Ph.D.

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Graduate Research Assistants: Jayde King, M.S. Yolanda Ortiz, M.S. Nick DeFilippis, M.S. Quirijn Berendschot, M.S.A. Jacqueline McSorley, M.S.

Outline

- Background
- Method
- Results
- Discussion

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Aviation Weather Product Interpretation Research

Purpose

- Use the questions we developed in Phase I
- Include pilots that are more representative of GA (age, flight hours/experience); Collaborate with AOPA
- Examine: Knowledge about aviation weather products; Differences between levels of flight certificate and/or ratings







Study Design

- 1. Coordinated with Rune Duke
- 2. 118 questions divided into 5 Tests/Surveys;
- 3. Study protocol approved by ERAU IRB
- 4. Implemented the 5 separate online surveys/tests (Qualtrics)
- AOPA sent out the survey 3 times (June 2017, August 2017, September 2017)

118 Questions Divided into 5 Tests



• CVA (5)

Participants

- More than 1000 pilots began the survey
- 837 pilots completed the whole survey and were included in analysis
 - Private pilot (Private)
 - Private pilot with instrument rating (Private with Instrument)
 - CPL with instrument (Commercial with Instrument)
 - CFI or CFII or anyone with additional certificates (CFI)
 - ATP (ATP)

Sample Size					
-		Test 1	Test 2	Test 3	Test 4
Participant age		n	n	n	n
M(SD) = 57 (13.8)	Private	69	35	40	55
	Private w/ Instrument	41	47	55	46
	Commercial w/ Instrument	39	22	11	29
	ATD	22	24	24	7

	n	n	n	n	n	Ν
Private	69	35	40	55	49	248
Private w/ nstrument	41	47	55	46	51	240
ommercial w/ nstrument	39	22	11	29	33	134
ATP	22	24	24	7	23	100
CFI	35	21	19	22	18	115
Total	206	149	149	159	174	837

Test 5

Total

Locations



Participant Mean Flight Hours



Error Bars: 95% Cl

There was a significant main effect for rating on flight hours, F (4,850) = 196.99, p < 0.01, partial eta squared = 0.48

Overall Flight Hours by Test



No significant interaction between test number and pilot rating on flight hours, F (16, 850) = 1.07, p = 0.38, partial eta squared = 0.02

Results

actual pilot deciding whether or not to fly in bad wx

ESNK 3	ARA 2413302 2414/2421 32016G25KT 9999 -SN BKNO45 11470 1410/1410
ESNA	2411302 2412/2421 32015925KT CAVOK-
ESNO	241130Z 2412/2421 31014G24KT 9000 -SN BEN040 TEMPO 2412/2421 2000 SN VV010 TEMPO 2415/2421 S6015G25K
ESNO	241130Z 2412/2421 02010WT 8000 -SN BKN030 11440 2412/2421 2000 SN 99010-
ESNS	2411302 2412/2421 35010KT 9000 -SN BKN030 TEMPO 2412/2421 4000 SN WV014-
10000	2411302 2412/2421 36012KT 9000 -SN BRN040 1000
ESH	2411302 2412/2421 32018025KT CAVOR-
ESN	X ARA 2411492 2412/2421 3801087 TEMPO 2412/2416 2801502887-
25	CE 2412302 2412/2421 30008KT CAVOX-
-	Check weather
	Fly TAF DECODER
	ROOM 2411302 2412
	KIND 241.

Overall Analysis

A 5x5 Between Groups ANOVA

Independent Variable 1: Test (Test 1 vs. Test 2 vs. Test 3 vs. Test 4 vs. Test 5)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

Effect of Rating on Score



Error Bars: 95% Cl

There was a significant main effect of pilot certificate/rating on score, F(4, 857) = 12.48, p < 0.01, partial eta squared = 0.55.

Effect of Test on Score



Error Bars: 95% Cl

There was a significant main effect of test on score F (4, 857) = 53.39, p < 0.01 partial eta squared = 0.20.

Interaction graph



The interaction was not significant, F (16, 857) = 1.11, p = 0.338, partial eta squared = 0.02.

Test 1 Analysis

A 4x5 Mixed ANOVA

Independent Variable 1: Topics within Test 1 (Data sources vs. Significant Weather vs. Storm Definitions vs. Flight Planning)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

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Test 1



Significant main effect of Product type on Test 1 score, Wilks' Lambda = 0.46, F (3, 202) = 78.29, p > 0.01. Partial

eta squared = 0.54.

Significant main effect of Pilot Rating on Test 1 score,

F (4, 204) = 3.03, p = 0.02, partial eta squared = 0.06.

Pilot Certificate/Rating Test 1 100.00-Private Private with Instrument Commercial with Instrument CFI 80.00-ATP Mean Score 60.00-40.00-20.00-.00-

Data Sources

LL Hazards Storm Definition Product Flight Planning

No significant interaction of Pilot Rating and Topic on Score

Wilks' Lambda = 0.90, F (12, 534.7) = 1.76, p = 0.053, partial eta squared = 0.03

Test 2 Analysis

A 4x5 Mixed ANOVA

Independent Variable 1: Topics within Test 2 (METAR vs. PIREP vs. TAF vs. Winds Aloft)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

Test 2





Significant main effect of product on Test 2 Score,

Wilks' Lambda = .30, F (3, 142) = 110.63, p < 0.01, partial eta

squared = 0.70

Significant main effect for Pilot Rating on Test 2 score,

F (4, 144) = 4.67, p = 0.01, partial eta squared = 0.12

Test 2



No significant interaction for Product and Pilot Rating/Certificate on Test 2 score,

Wilks' Lambda = .91, F (12, 375.99) = 1.16, p = 0.313, partial eta squared = 0.03.

Test 3 Analysis

A 3x5 Mixed ANOVA

Independent Variable 1: Topics within Test 3 (CIP vs. GAirmet vs. GTG)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

Test 3



Significant main effect found of Product on Test 3 score, Wilks' Lambda = 0.44, F (2, 144) = 90.8, p < 0.01, partial

eta squared .56.

No significant main effect of Pilot Rating on Test 3 score,

F (4, 145) = 2.25, p = 0.59, partial eta squared = 0.06



No significant interaction of Product and Pilot Certificate/ Rating on Test 3 score,

Wilks' Lambda = 0.94, F (8, 288) = 1.09, p = .37, partial eta squared = 0.03

Test 4 Analysis

A 3x5 Mixed ANOVA

Independent Variable 1: Topics within Test 4 (Radar vs. SIGMET vs. Thunderstorm)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

Test 4



There was a significant effect for product on score,

Wilks' Lambda = 0.54, *F* (2, 192) = 67.69, *p* < 0.01, partial

eta squared = 0.46.

A significant main effect also occurred for Pilot Certificate/Rating on score, F(4, 193) = 6.16, p < 0.01,

partial eta squared = 0.11.

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There was no significant interaction found between Product and Pilot Certificate/Rating,

Wilks' Lambda = 0.95, F (8, 384) = 1.17, p = 0.32, partial eta squared = 0.02

Test 5 Analysis

A 4x5 Mixed ANOVA

Independent Variable 1: Topics within Test 5 (CVA vs. Satellite vs. Station Plot vs. Surface Prognostic)

Independent Variable 2: Pilot Rating (Private vs. Private w/Inst vs. Commercial w/Inst vs. CFI vs. ATP)

Dependent variable: Percent Correct (Score)

Test 5



There was a significant main effect for product on score, Wilks' Lambda = 0.37, F (3, 169) = 96.74, p <

0.01, partial eta squared = 0.63.

There was no significant main effect of Pilot

Certificate/Rating on score, *F* (4, 171) = 0.21, *p* = 0.16,

partial eta squared = 0.04.



There was no significant interaction between Pilot Certificate/ Rating and Product on

Score, Wilks' Lambda= 0.93, F (12, 447.4) = .996, p = 0.45, partial eta squared = 0.02.



Key Takeaways

- A major contributing factor in the weather accidents may be GA Pilots' inability to interpret weather displays.
- GA Pilots of ALL ratings and certificates are struggling on some products
 Radar, Satellite, Station Plots
- Good news:
 - Better scores on GTG
- Further research is needed to understand why these gaps exist and how to fix them.
 - Display design?
 - Training?



Questions?



