Helping GA pilots interpret NEXRAD in Convective Weather Situations

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Problem

- Research has shown that GA pilots using data linked NEXRAD Radar do not understand all the facets of radar.
  - Used data link radar for tactical decision making (Latorella & Chamberlain, 2002).
  - Made tactical decisions when the radar resolution was higher (Beringer & Ball, 2004).
- A training module, "NEXRAD in convective weather," improved young pilots' radar knowledge, application skills, and confidence in using NEXRAD (Roberts, Lanicci, & Blickensderfer, 2011).

Purpose of current study

Further evaluate the Roberts et al. (2011) course:

- non-ERAU or current university students
- another region of the U.S.
- Part 61

Current Study

- 2 x 3 Mixed Design
- Independent Variables:
  - Location
    - KC x Chicago x Boston
  - Training
    - Pre-training scores x Post-training scores
- Dependent Variables
  - Radar Knowledge Test
  - Scenario Application Test
  - Self-Efficacy Questionnaire

Participants

- **Kansas City**
  - N = 24
  - Age: M = 58.9 (SD = 10.0)
  - Flight hours: M = 2348.3 (SD = 2832.83) Mdn = 765
  - 20 held instrument rating
- **Chicago**
  - N = 18
  - Age: M = 58.2 (SD = 10.6)
  - Flight hours: M = 2370.6 (SD= 4150.13) Mdn = 487.5
  - 14 instrument rating
- **Boston**
  - N = 32
  - Age: M = 50.7 (SD= 14.8)
  - Flight time: M = 2363.8 (SD = 4998.49) Mdn = 380
  - 19 instrument rating

Robert et al. (2011):

31 ERAU pilots received course

Mean age: 21.8 years

Mean flight time: 328.47 hours

- Recruited through flying clubs, the Civil Air Patrol, and flyers posted in FBO's
- Participants compensated with $50 and WINGS credit (and lunch).

Participants

Participants by FAR training part and location

		Private		Commercial		Air Transport Pilot		
		Part	Part	Part	Part	Part	Part	Part
	n	61	141	61	141	61	141	142
Kansas City (KC)	24	18	3	9	3	2	1	1
Chicago	18	12	3	5	3	0	2	0
Boston	32	26	1	9	1	2	0	0
Overall	74	**56**	**7**	**23**	**7**	**4**	**3**	**1**

Note: Not all participants responded to this portion of the questionnaire.

Training Module

- Lecture based course
- Radar Basics, NEXRAD, Radar Modes, Thunderstorms, Using NEXRAD for Decision Making
- Two paper-based flight scenarios
  - Learners applied knowledge from course to respond to questions
  - Instructor gave feedback
- ~ 2 hours; breaks as needed.

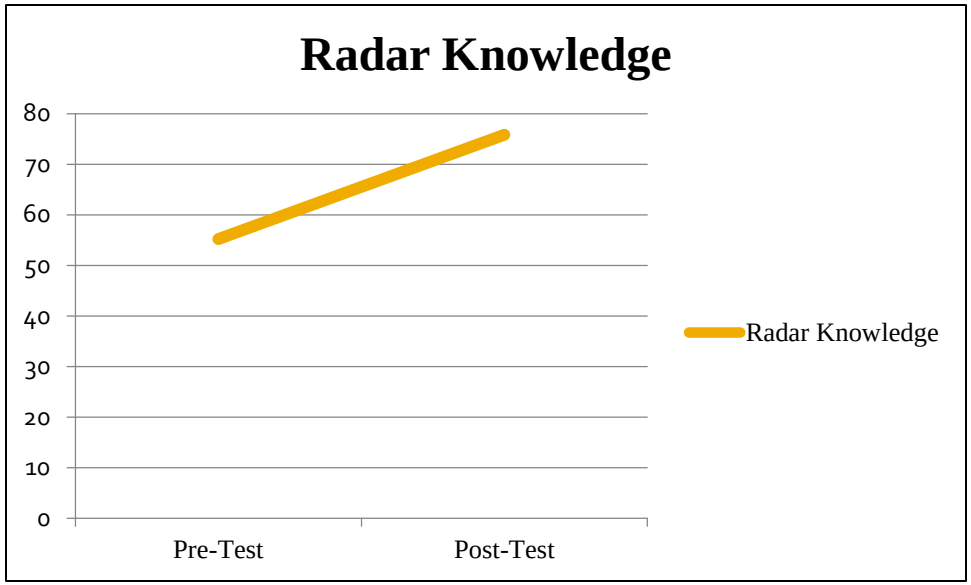
Procedure

- Consent & Pre-test
- Course module
- Lunch
- Practice Scenarios
- Post-test
  - Parallel form questions
  - Additional novel scenario
- Debrief & compensation
- Total time: 6 hours

Effect of Training

Radar Knowledge Test:

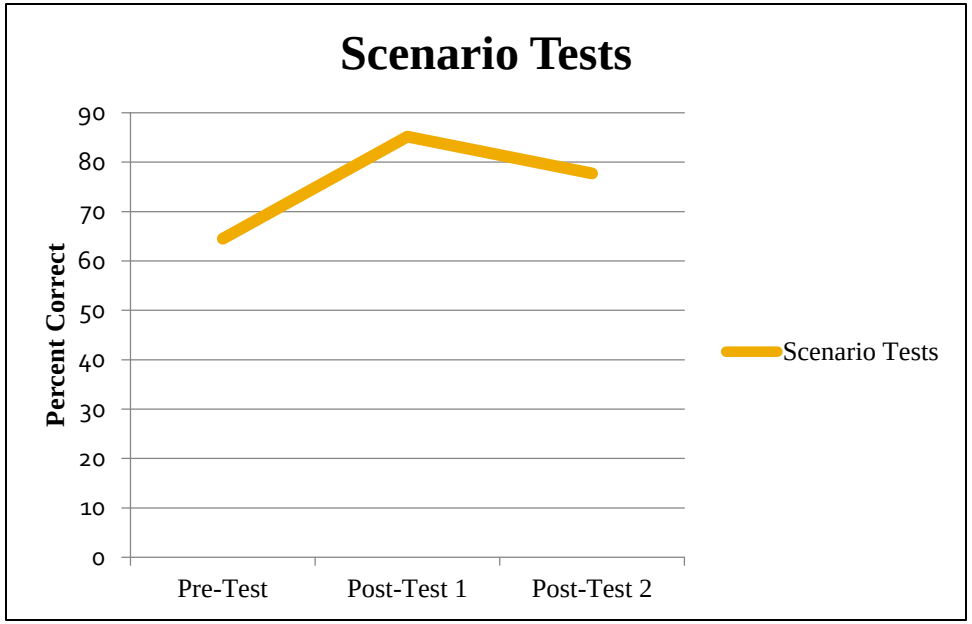
- $F(1, 69) = 218.50$, $p < .001$, $\eta^2 = .76$



Effect of Training

Scenario Tests:

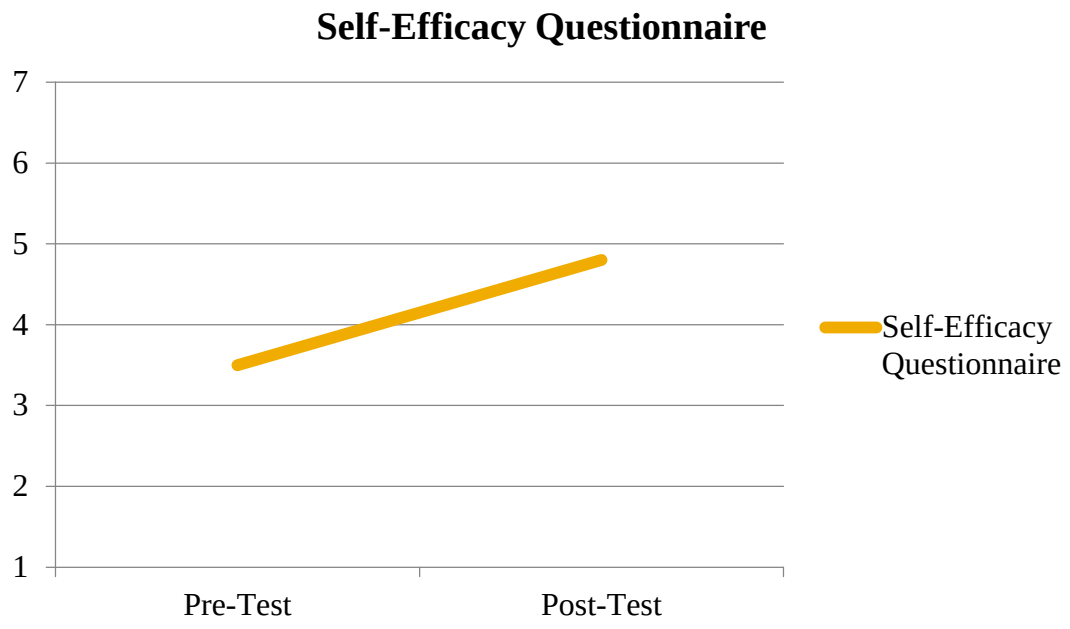
- $F(1, 69) = 170.58$, $p \leq .01$, $\eta^2 = .712$
- Pretest: 65%
- Posttest 1: 85%
- Posttest 2: 71%



Effect of training

Self-Efficacy Questionnaire:

- $F(1, 69) = 94.32$, $p \leq .001$, $\eta^2 = .58$



Reactions

- Participants rated the course highly
- M = 6.54 (SD = .51)
- (1 = Low, 7 = high)

Discussion

- Course appears to be effective with typical GA pilots.
- Similar pattern of results to Roberts et al. (2011).
- Course was given by a "naïve" instructor.
- Pre-test scores indicated pilots have limited knowledge about weather radar.
- Limitations: no control group; no retention test; no performance (flight) data.
- *This short course has potential to increase pilots' interpretation of in-cockpit weather radar displays.*

Thank you!

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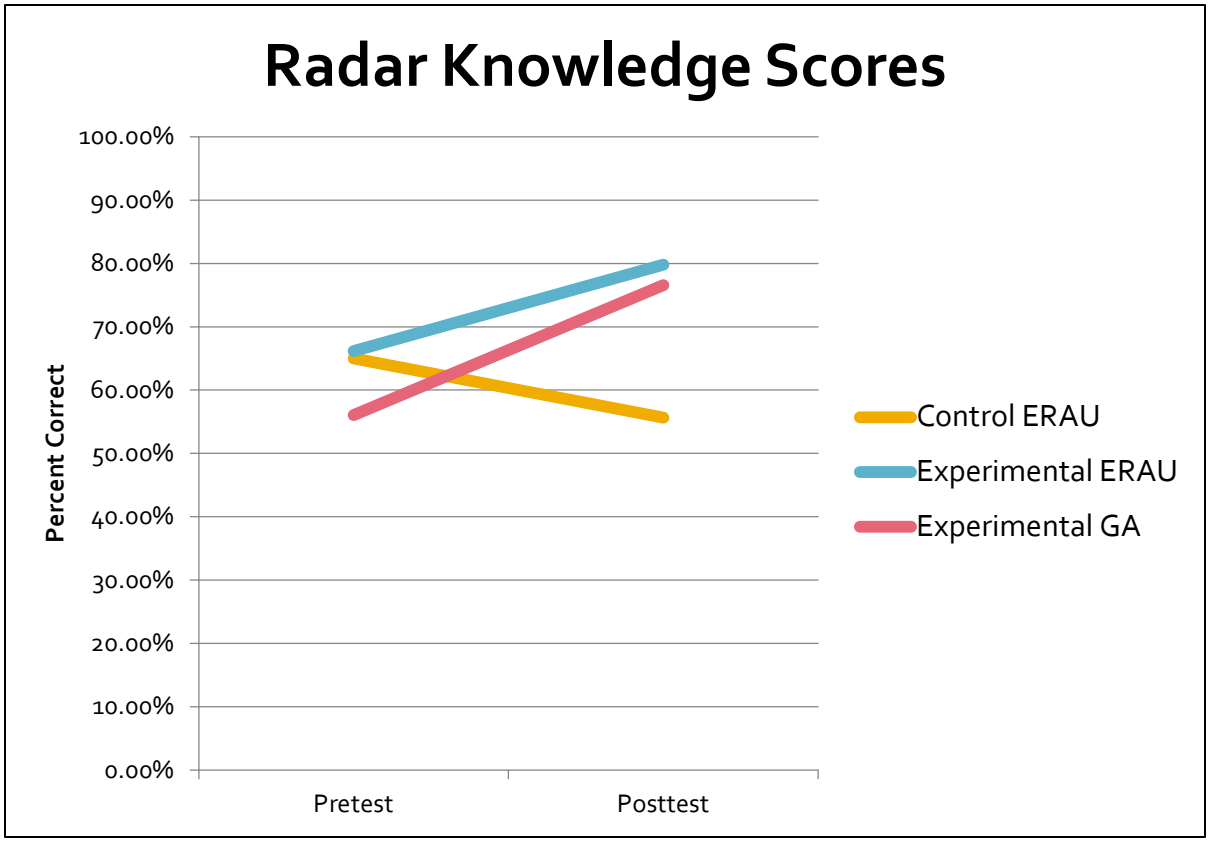
Comparison Study

- 2 x 3 Mixed Design
- Training (pre vs. post)
- Condition: 3 levels:
  - Embry-Riddle control group (Roberts et al., 2011 dataset)
  - Embry-Riddle experimental group (Roberts et al., 2011 dataset)
  - General Aviation group (Current dataset)
    - Randomly selected 30

Interaction of Training and Condition

- Radar Knowledge

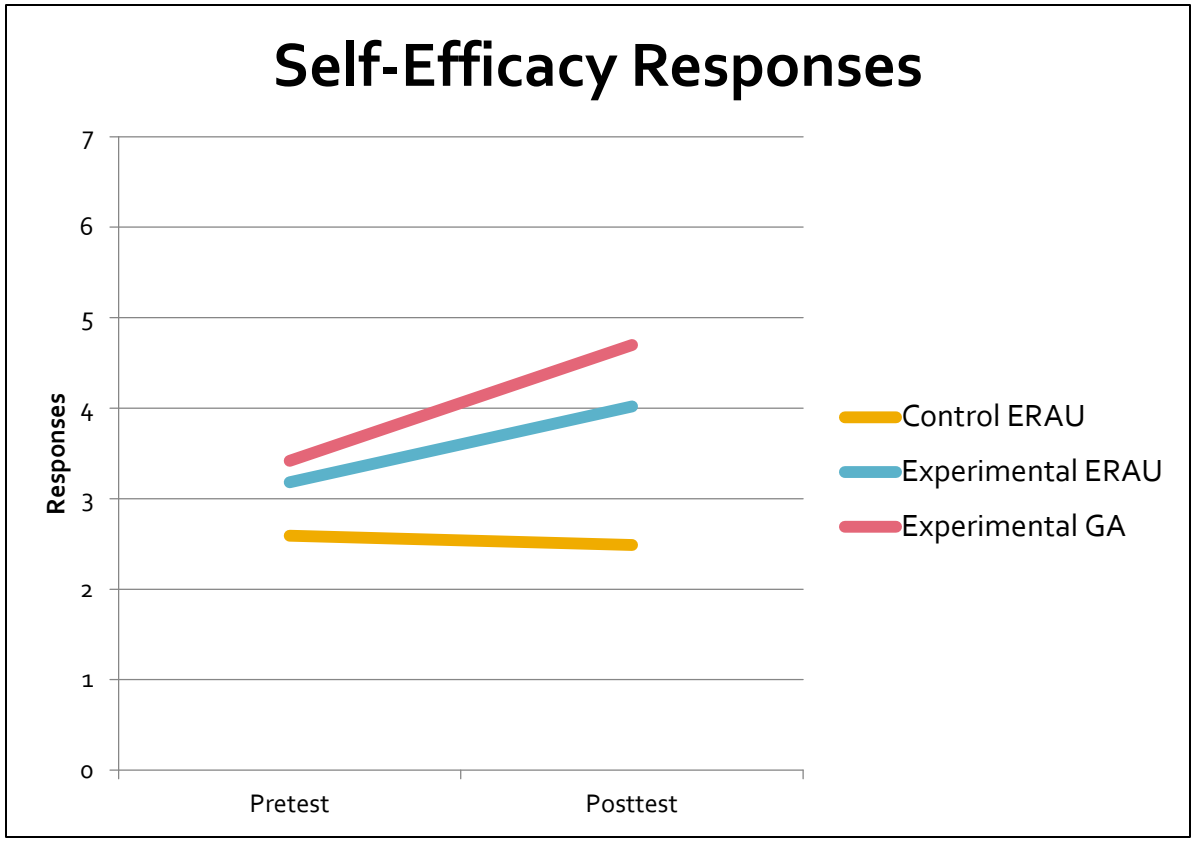


Interaction of Training and Condition

- Scenario Test

Interaction of Training and Condition

- Self-Efficacy



Discussion

- All performed significantly better than the ERAU control group
- GA pilots outperformed the ERAU pilots
  - GA pilots draw from greater experience?
  - Course instructor was more effective in the GA condition?
  - GA pilots more motivated?
- *Overall, course has strong potential to help GA pilots understand NEXRAD*

Thank you!

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MANOVA Results

- Significant main effect of training (pre vs. post)
  - *Wilks lambda* $F(3, 67) = 142.24$, $p = .001$, $\eta^2 = .86.4$
- Significant main effect of location
  - *Wilks lambda* $F(6, 134) = 3.00$, $p = .009$,
- No significant interaction
  - $F(6, 134) = .76$, $p = .605$

Location: Univariate follow-up

- MANOVA revealed significant effect of location
- Univariate revealed no main effect for location
  - Radar Knowledge: $F(2, 69) = .877$, $p = .420$
  - Scenario: $F(2, 69) = 2.05$, $p = .136$
  - Self-Efficacy: $F(2, 69) = .239$, $p = .788$
- Uneven groups

Results: MANOVA (Analysis 2)

MANOVA revealed a significant main effect for each:

- Condition: $F(6, 170) = 16.09$, $p \leq .001$, $\eta^2 = .36$
- Training: $F(3, 85) = 40.54$, $p \leq .001$, $\eta^2 = .58$
- Condition x Training:
  - $F(6, 170) = 31.16$, $p \leq .001$, $\eta^2 = .52$.

Means (Analysis 2)

	Pretest Mean	SD	Posttest Mean	SD
Radar Knowledge Scores				
Control ERAU	65.00%	8.77%	55.66%	9.79%
Experimental ERAU	66.15%	8.08%	79.80%	7.60%
Experimental GA	56.04%	12.55%	76.59%	11.38%
Scenario Scores				
Control ERAU	57.11%	14.72%	56.86%	13.23%
Experimental ERAU	62.00%	13.80%	75.76%	10.69%
Experimental GA	64.04%	15.64%	86.14%	10.20%
Self Efficacy Scores				
Control ERAU	2.59	1.23	2.49	1.1
Experimental ERAU	3.18	0.968	4.02	0.6498
Experimental GA	3.42	0.41	3.83	0.533