8.4 APPLYING THE CONCEPT OF WEATHER SALIENCE TO A SPECIFIC USER COMMUNITY: GENERAL AVIATION PILOTS

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1. INTRODUCTION

Environmental psychology is a field of study that is concerned with the interaction of humans with their environments, where the latter can be either the natural or built environments (De Young, 2013). Deriving from this human-natural environmental interaction idea, Stewart (2009) developed the concept of *weather salience*, which he defined as "…the degree to which individuals attribute psychological value or importance to the weather and the extent to which they are attuned to their atmospheric environments." Weather salience has been studied as a means to better understand people's 'weather mindsets' in order to improve the applicability and utility of currently available weather and climate products (Stewart et al., 2012).

Stewart's data collections encompassed samples of a university student population and the U.S. general population. To the best of our knowledge, weather salience data have not yet been collected on a specialized group of weather product users, and the population of Embry-Riddle flight students constitutes a readily available pool of such users. Student pilots comprise a specific group under the umbrella of general aviation (GA), which is defined as "All civil aviation operations other than scheduled air services and non-scheduled air transport operations for remuneration or hire" (Transport Canada, n.d.).

The present study began as an investigation of GA pilot weather education and training issues under the Federal Aviation Administration (FAA) funded project "Data-Link Weather in the Cockpit Training Tools and Strategies". As a part of the study, a set of weather knowledge questions were developed by the researchers and administered to a sample of student pilots at Embry-Riddle Aeronautical University's (ERAU) Daytona Beach, FL campus. Participants were asked to complete an online survey consisting of demographic, weather knowledge, self-efficacy, and weather salience questions. They were volunteers and compensated $50 for their participation.

The Weather Salience Questionnaire (WxSQ; Stewart, 2009; Stewart et al., 2012) was used for the weather salience portion of the survey. The rationale for including the WxSQ as part of the data collection was motivated by concerns about use and misuse of real-time data-linked weather products by GA pilots in pre-flight planning and during flight (e.g., National Transportation Safety Board, 2012). We believe that this same 'weather mindset' issue applies to aviation weather products as utilized by the GA community. We wanted to get some idea of the weather 'baseline' of this very specialized portion of the population before developing any further initiatives in the education and training area.

2. DATA AND METHODS

We are interested in comparing the weather salience of pilots in the GA community to other segments of the general population. Students from ERAU with varying levels of flight experience were used as participants. The WxSQ used in this study is the 29-question version with seven subscales outlined in Stewart (2009). The mean responses on the subscales were compared to the mean responses from Stewart's (2009) University of Georgia (UGA) student sample and the mean responses collected from the general population sample (Stewart et al., 2012). Two-tailed one-independent sample *t*-tests were used for all analyses.

All WxSQ scoring was performed in accordance with the procedure described by Stewart (2009). Responses to items were Likert-style, ranging from 1 (*Strongly disagree/Never*) to 5 (*Strongly agree/ Always*). Mean scores were calculated for each of the seven subscales by summing the mean numerical ratings for all items within each subscale. The total WxSQ score was computed by summing the mean numerical ratings for all items. Higher scores on both the total WxSQ score and subscales indicate higher weather salience. Total WxSQ scores can range from 29 to 145. Questions 6, 7, and 8 were reverse scored and four items loaded onto multiple subscales.

The mean WxSQ subscale and total scores in both the UGA and general population samples were reported by gender (see Table 2 in Stewart, 2009 and Table 1 in Stewart et al., 2012). Overall means across genders were derived by calculating weighted means.

Participants consisted of 80 flight students from ERAU, ranging in age from 17 to 33 years (mean = 20.61, SD = 2.55; median = 20). Of the 80 participants, the following is the breakdown of highest license/rating held: private pilot (n = 26); instrument rating (n = 27); commercial license (n = 27). These numbers reflect the highest level that the participants had achieved or were in training to achieve. In

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addition, six of the 80 participants were certified flight instructors (CFI) and four were certified flight instructors-instrument (CFII). The median number of total flight hours was 122.00, the median number of simulated instrument flight rules (IFR) hours was 15.00, and the median number of actual IFR hours was 2.00. The median number of years flying was 2.00. The majority of participants had completed most of their flight training in Florida (*n* = 69); two participants completed most of their training in Puerto Rico, and the remainder in various other states.

3. RESULTS

ERAU flight student scores on the WxSQ overall ranged from 43 to 108, with a mean of 72.77. ERAU flight students' mean scores were significantly lower than those of both the UGA students and the general population samples on the total WxSQ scores as well as on six of the seven subscales. Table 1 shows the mean scores on each subscale and total score for each sample, along with the results of the significance tests and effect sizes. All effect sizes are reported as Cohen's *d*.

Subscale (possible score range)	ERAU Students Mean (SD)	UGA Students Mean; *t*-statistic	Gen. Population Mean; *t*-statistic
1: Attention to weather and weather products (9 to 45)	24.99 (4.51)	29.21 $t(79) = -8.38$, $p < .001$ $d = -.94$	30.93 $t(79) = -11.79$, $p < .001$ $d = -1.32$
2: Sensing and observing weather directly (5 to 25)	8.53 (2.92)	18.30 $t(79) = -29.93$, $p < .001$ $d = -2.92$	17.99 $t(79) = -28.98$, $p < .001$ $d = -3.24$
3: Effects of weather on daily activities (3 to 15)	8.04 (2.58)	7.61 No significant difference ($p > .05$)	7.81 No significant difference ($p > .05$)
4: Effects of weather on daily mood (6 to 30)	17.91 (5.05)	21.15 $t(78) = -5.70$, $p < .001$ $d = -.64$	22.64 $t(78) = -8.32$, $p < .001$ $d = -.94$
5: Attachment to weather patterns (3 to 15)	8.03 (3.57)	9.98 $t(79) = -4.90$, $p < .001$ $d = -.55$	10.18 $t(79) = -5.40$, $p < .001$ $d = -.60$
6: Need to experience weather variability (4 to 20)	9.61 (3.37)	13.04 $t(79) = -9.10$, $p < .001$ $d = -1.02$	15.97 $t(79) = -16.88$, $p < .001$ $d = -1.89$
7: Attention to weather leading to holiday or cancellation (3 to 15)	5.76 (2.90)	13.21 $t(79) = -23.00$, $p < .001$ $d = -2.57$	8.86 $t(79) = -9.57$, $p < .001$ $d = -1.07$
Total WxSQ score (29 to 145)	72.77 (12.50)	98.96 $t(77) = -18.50$, $p < .001$ $d = -2.10$	114.38 $t(77) = -29.39$, $p < .001$ $d = -3.33$

Table 1. Results of *t*-tests comparing ERAU student means on subscales and total score with those of UGA students and the general population.

Subscale 3 (Effects of weather on daily activities) was the only subscale in which there were no significant differences between the flight students and the other two samples. A series of one-independent sample *t*-tests were performed to compare the means of the flight students and the general population on each of the three individual questions that comprised Subscale 3. UGA student means for the individual questions were not available from Stewart's (2009) results and were not included in the analyses. Compared to the general population sample, ERAU flight students scored significantly lower on Question 5 and significantly higher on Question 28 (see Table 2).

Question	ERAU students Mean (SD)	Gen. Population Mean; *t*-statistic
5) I plan my daily routine around what the weather may bring.	2.49 (1.16)	3.01 $t(79) = -4.04$ $p < .001$ $d = -.45$
28) During certain seasons of the year, the weather conditions routinely (i.e., at least once per week) affect my ability to perform tasks at school or work.	2.99 (1.34)	2.53 $t(78) = 3.02$, $p = .003$ $d = .34$
29) The work that I do (or did previously) is affected by the daily weather conditions.	2.56 (1.36)	2.28 No significant difference ($p > .05$)

Table 2. Results of *t*-tests comparing ERAU student means on individual questions of Subscale 3 with those of the general population.

Additional analyses were performed to identify correlates of weather salience in the flight students. Initial analyses indicated that significant trends were not found for previous college-level meteorological coursework completed or number of flight hours.

4. DISCUSSION

ERAU flight students had significantly lower overall WxSQ scores than both of the test samples. Not only did they score lower than the general population, but they also scored lower than another sample of college students of a similar age, the UGA sample (mean = 19.2 years, *SD* = 1.8). They also scored significantly lower on six of the seven subscales.

Given the nature of the questions, Subscale 3 (Effects of weather on daily activities) was thought to be the most relevant subscale to flight-related activities. Only on Subscale 3 did ERAU students score higher; however, this difference was not significant.

5. CONCLUSIONS

The initial finding that ERAU flight students have significantly lower scores on the WxSQ raises the question of whether this particular instrument is appropriate for assessing weather awareness and use of weather products in specific user groups, notably in the GA community. On the one hand, the WxSQ provides a valid baseline measure of weather salience. On the other hand, it could be argued that the questions could be modified to address more specifically the user group's environmental and work-related characteristics. However, developing a specialized weather-related questionnaire for specific user groups could then risk deviating from the original concept of weather salience as defined by the Stewart studies.

Future work will involve analyzing ERAU flight students' WxSQ scores by flight experience variables (e.g., by highest level of licensure/certification achieved). It is also of interest to investigate how other user groups may respond to the WxSQ; future work may involve administering this instrument to meteorology and air traffic control students.

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