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Analysis of Low-Time Pilot Attitudes in University Aviation Association Member Flight Schools

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Hazardous attitudes, such as antiauthority, impulsivity, invulnerability, macho, and resignation, may increase the risk of accident or incident in aviation. Hazardous attitudes is an overarching term, based on different perceptions and behaviors, which may negativity affect aeronautical decision making, and therefore safety, in pilots. The Aviation Safety Attitudes Scale, addresses attitudes in three areas (Self-Confidence, Risk Orientation, and Safety Orientation), was given to 302 low-time pilots (fewer than 250 hours of flight time). The purpose of this quantitative, survey research was to determine the potential hazardous attitudes of flight school students. Factorial Analysis revealed differences in three areas among the sample: Certification by Number of hours flown in previous 90 days interaction on Safety Orientation was overall statistically significant, $F(2,296)=6.333$, p=.002; Certification by Gender integration on Risk Orientation was overall statistically significant, $F(1,294)=4.48$, $p=.035$; and Gender by Certification interaction on Self-Confidence was overall significant, $F(1,294)=10.324$, $p=0.01$. The researchers concluded that although the overall hazardous attitudes of pilots are similar, there may be additional opportunities for instructors and curriculum developers to continually reinforce hazardous attitude awareness.

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Safety is regarded as a key important element in aviation. To ensure passenger and staff safety, modern aviation lines engage in a number of strategies, quality assurance, and prevention programs to ensure the highest safety standards. One of the safety factors associated with an increased risk of incident is a phenomenon known as hazardous attitudes (Blakaj et al., 2018; Molesworth & Chang, 2009). Hazardous attitudes toward safety can be characterized as an umbrella term which refers to a number of individual perceptions and behavioral strategies which may cloud decision making in pilots and thus lead to incidents (Lee & Park, 2016). Please see Table 1.

Table 1
Description of the Five Hazardous Thoughts within Aeronautical Decision Making

Name	Description
Antiauthority	"Don't Tell Me What to Do"
Impulsivity	"Do Something Quickly!"
Invulnerability	"It Won't Happen to Me"
Macho	"I Can Do It"
Resignation	"What's the Use?"

Note. The five most common hazardous attitudes within aviation. Adapted from "AC 60-22" by Federal Aviation Administration, 1991, Appendix 4. Retrieved from https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_60-22.pdf

The original documentation of hazardous thoughts and attitudes was presented in the Federal Aviation Administration (FAA) (1991) Advisory Circular (AC) 60-22. These five hazardous thoughts are still today the foundation of aeronautical decision making, and are the basis for Hunter's Aviation Safety Attitude Survey (ASAS), presented in this paper.

Hazardous thoughts, attitudes, and actions are all part of the safety mindset and culture. Hunter's (2005) original Aviation Safety Attitude Survey used the terms interchangeably. For example, Hunter's ASAS measures hazardous attitude responses to questions regarding self-confidence, risk taking, and safety orientation. Since attitude is a fundamental part of a safety mindset, and to avoid confusion, the term *hazardous attitude* will be used throughout this paper.

Not all hazardous attitudes are always bad. Attitudes of *macho* and *resignation* can, in limited situation, be positive attributes. A controlled use of "I can do it" can help build confidence and limited use of "What's the use?" can help pilots make safer decisions by not attempting to fly into hazardous weather. For the majority of time, however, hazardous thoughts and attitudes such as being macho, antiauthority, resignation, impulsive, and invulnerable are believed to contribute to road traffic incidents (Blakaj et al., 2018) and endanger patient`s lives within clinical and sport settings (Bruinsma, Becker, Guitton, Kadzielski, & Ring, 2015; Cogburn, Horton, & McNeil, 2017). Importantly, Lee and Park (2016) pointed out that despite its importance, the problem of hazardous attitudes and approaches towards its assessment are poorly understood.

Literature Review

Many studies in aviation (Lee & Park, 2016; Wang, Zhang, Sun, & Ren, 2018) and other industries (Blakaj et al., 2018; Bruinsma et al., 2015; Cogburn et al., 2017) have been researching the problem of hazardous attitudes. Prior to further analyzing the concept and its assessment, it is important to define its meaning. Lee and Park (2016) offered the following definition of the term hazardous attitudes: "…the tendencies of individuals to react to stimuli in such a way that risks increase in a given situation or event" (p. 70). Hazardous attitudes are a complex multi-facet phenomenon, associated with a number of negative outcomes across a variety of professional contexts. For example, Blakaj et al. (2018) reported that hazardous attitudes are associated with an increased risk of making wrong decisions regarding patient`s radiation treatment in oncology.

Hazardous attitudes can have a profound impact on aeronautical decision-making process, self- reported incidents, and crew resource management. Most importantly, different hazardous attitudes such as *confidence* may make pilot's assessment of risks and difficult situation blurred and cause them to perceive such situations as less risky than they actually are (Hyde & Cross, 2018). Lee and Park (2016) highlighted that hazardous attitudes impact how the pilots perceive their own abilities to handle complex situations, thus altering decision-making process.

According to the evidence provided by Qi, Lai, and Jia (2018) and Lee and Park (2016), hazardous attitudes can be effectively changed via educational and training interventions. Importantly, hazardous attitudes can be viewed as personal motivational tendencies of pilots which impact their judgement and ability to make sound and safe decisions (Qi et al., 2018). The first step in addressing hazardous attitudes is identifying them and recognizing them as a problem. A number of assessment tools have been developed to measure hazardous attitudes among pilots. One of the most widely recognized tools is the Aviation Safety Attitude Scale developed by Hunter (1995).

Wang et al. (2018) conducted a mixed-method research to understand the relationship between cognitive variables and risky flight behaviors among the population of airline transport pilots. The researchers conducted one-way ANOVA and correlation tests to quantify the relationships between the variables, and the concept of risky pilots emerged. Three cognitive variables have a strong correlation with a pilot being characterized as a risky one: risk perception, hazardous attitude, and risk tolerance. Wang et al. (2018) concluded that hazardous attitude is correlated with a risk of incidents of unsafe and risky events; moreover, targeted training and educational interventions can help improve and correct pilot`s risky attitudes.

Lee and Park (2016) performed a quantitative cross-sectional study of hazardous attitudes among passenger airline pilots of Korean and non-Korean origin. The goal of the study was to identify any differences in attitudes and behavioral patterns between the two groups of pilots (n=147). A t-test and ANOVA statistical analyses were used to compare pilots` attitudes and behaviors using a 56-item questionnaire, which included the questions from the ASAS. According to the obtained results, there were significant differences in the conceit factor was observed ($p < .001$) between Korean and non-Korean pilots. The average value for the conceit factor was higher for the non-Korean pilots. Interestingly, regardless of cultural background, pilots who had less than 1,000 and more than 10,000 hours of flight time experienced significantly fewer tendencies towards hazardous attitudes. The limitation of this research is that Lee and Park (2016) did not use any of the widely adopted hazardous attitude measurement tools, and instead chose to create their own instrument by integrating the elements of the ASAS and other questionnaires.

A number of demographic factors must be taken into account when attempting to measure hazardous attitudes and risky behaviors among pilots. One important characteristic is gender of the pilot. Furedy (2019) conducted a quantitative study to identify whether significant differences in hazardous attitudes exist between male and female pilots. Rather than adopting the ASAS tool, Furedy (2019) instead adopted the New Hazardous Attitudes Scale (the New-HAS) questionnaire. The New-HAS is a self-assessment tool developed by Hunter (2005), and similarly to the ASAS, is based on Likert-scale responses. As opposed to the ASAS, the New-HAS contains a total of 88 simple declarative statements, which the respondents have to evaluate. According to the obtained results, female pilots had significantly higher hazardous attitude scores in the more advanced levels of training suggesting that gender differences indeed exist.

A number of experts have voiced an opinion that flight accidents are complex events, and although it is important to consider human error, this factor alone rarely causes a fatal incident (Qi et al., 2018). Dismukes, Berman, and Loukopoulos (2016) conducted a retrospective cross-sectional research to understand the relationship between different factors leading to incidents and fatal events and concludes that conducted expertise often operates using limited evidence. Dismukes et al. (2016) warned against using pilot hazardous attitude testing as a sole predictor of safety risks and incidents. As discussed above, hazardous attitudes depend on a number of factors, including pilot`s gender, level of training and professional experiences. Therefore, such attitudes are prone to change and should be assessed systematically.

Problem

Safe aircraft operations occur from a combination of skill and pilot attitude. Skill is traditionally measured and evaluated during training and check rides. Pilot attitudes have no pre-defined times to be evaluated. Although instruments such as the ASAS have been used successfully with higher-time pilots (more than 250 flight hours) by researchers such as Hyde and Cross (2017) and Lee and Park (2016), assessment of lower-time pilot (250 or fewer flight hours) attitudes is lacking. The 250-hour delineation occurs because a pilot with fewer than 250 hours is traditionally considered either a pilot flying only for personal pleasure or a pilot working to obtain certification to fly for compensation. The problem is the lack of data regarding low-time pilot's attitudes toward safety. Understanding and establishing correct safety attitudes early in a pilot's career will help ensure safer long-term operations.

Purpose

The purpose of this quantitative, survey research was to determine if significant differences existed in potential hazardous attitudes of flight school students. Although prior research has analyzed hazardous pilot attitudes, little research has been conducted to specifically determine attitudes of low-time pilots in university aviation flying programs. This research helps fill a gap in the literature as an accurate assessment of low-time pilots.

Method

This research employed a quantitative, survey method to determine the potential hazardous attitudes of current flight school students. There are approximately 559 non-university (independent) flight schools within the US (FAA Flight Schools, 2019). An independent flights school's pilot enrollment can continuously fluctuate between just a few students up to hundreds of students for a large school. Attempting to survey all student pilots within this group was impractical due to the difficulty in contacting each flight school individually.

One group, the University Aviation Association (UAA), provided an ideal setting to conduct purposive sampling. The UAA is an organization comprised of 236 schools, which include 127 flight programs, located in the US and eight foreign countries. The UAA mission is "a professional association and unifying voice for promoting and furthering aviation education as a collegiate academic discipline" (UAA, 2019, p. 1). The UAA is the leader in coordinating, guiding, and providing safety and curricula information for aviation schools. It is estimated there are approximately 3,000 flight students within the UAA system, which the authors considered representative of all collegiate flight schools. Pilot training in university settings offer optimal purposive sampling opportunity because of the number of pilots who fly under standardized curriculum, as opposed to pilots who attend individual flight schools outside of a university setting, moreover, the results can be used to validate and update current training programs.

Research Question

RQ: Do UAA flight school students exhibit a similar extent of hazardous attitudes, based on the attributes of age, gender, highest level of certification, possession of an instrument rating, total flying time, and flight time, while in flight school training?

Hypothesis

$H1_a$: There is a significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Self-Confidence.

$H1_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Self-Confidence.

$H2_a$: There is a significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Risk Orientation.

$H2_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Risk Orientation.

$H3_a$: There is a significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Safety Orientation.

$H3_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Safety Orientation.

Procedure

This research was approved by the Embry-Riddle Aeronautical University IRB, protocol #19-113. A request for participation was sent to all UAA member schools via the UAA newsletter. The request was for low-time pilots (fewer than 250 hours) to complete the ASAS. Using G*Power, a minimum sample size of 270 was sought. A total of 302 survey were completed.

Instrument

The Aviation Safety Attitudes Scale was used for this research (see Appendix). These items are designed to measure pilot's attitude towards various hazardous attitudes, and in turn, aviation safety issues. The developed scale contains two items to measure the five thought patterns identified as hazardous by the FAA, including *macho*, *antiauthority*, *impulsive*, *invulnerable*, and *resignation*. The remaining survey items were designed to address other possible attitudes associated with risky flying or safety concerns.

The ASAS categorized the 27 hazardous attitudes into three general areas: Self-Confidence, Risk Orientation, and Safety Orientation. Hunter created the 27-question, Likert-style survey to directly assess the five hazardous attitudes originally presented from Table 1. Fourteen of the statements address self-confidence, eight statements address risk orientation, and four statements address safety orientation. One statement addressed technical knowledge, but not attitude. This question, #14, was designed to give feedback on the student's perception of the accuracy of the forecasts, but was not considered part of the hazardous attitudes. The individual statements are combined within the three categories to give a representative description of an individual's attitude toward self-confidence, risk orientation, and safety orientation.

Hunter (2005, 2015) assessed both the validity and reliability of the ASAS. According to the performed retrospective analysis, within the context of the ASAS scale, a total of 14 out of 27 observed correlations between hazardous attitudes and risky behaviors were statistically significant. High levels of significance was observed in relation to the ASAS subscale of Risk Orientation with 7 out of 10 validation measures were significantly correlated. According to Hunter (2005), such results indicate that "… those pilots with the greatest risk orientation also believed that the outcome of situations was largely due to external influences beyond their control" (p.37). Hunter (2005) has also demonstrated a relationship between the Risk Perception, Risk Tolerance, and Self-Confidence scales: pilots with the highest level of self-confidence also judged the flight situation to be less risky when compared to other pilots. Overall, the ASAS tool has a high internal and external reliability (Hunter, 2015). This study also demonstrated that the ASAS tool has a high level of validity as a number of studies adopt this tool to evaluate hazardous attitudes and risky behaviors among pilots.

Hunter's grouping of the questions, into the three categories of Self-Confidence, Risk Orientation, and Safety Orientation, are presented in Tables 2 and 3.

Table 2
Individual Statements as Grouped by Area

	Self-Confidence	Risk Orientation	Safety Orientation
Statements	2, 4, 6, 7, 8, 9, 10, 13, 18, 20, 21, 22, 23, & 25	1, 5, 12, 16, 19, 24, 26, & 27	3, 11, 15, &17

Table 3
Numerical Statements as Grouped by Area

		Self-Confidence	Risk Orientation	Safety Orientation
Statement				
1	I would duck below minimums to get home.		X	
2	I am capable of instrument flight.	X		
3	I am a very careful pilot.			X
4	I never feel stressed when flying.	X		
5	The rules controlling flying are much too strict.		X	
6	I am a very capable pilot.	X		
7	I am so careful that I will never have an accident.	X		
8	I am very skillful on controls.	X		
9	I know aviation procedures very well.	X		
10	I deal with stress very well.	X		
11	It is riskier to fly at night than during the day.			X
12	Most of the time accidents are caused by things beyond the pilot's control.		X	
13	I have a thorough knowledge of my aircraft.	X		
14	Aviation weather forecasts are usually accurate.			
15	I am a very cautious pilot.			X
16	The pilot should have more control over how he/she flies.		X	
17	Usually, your first response is the best response.			X
18	I find it easy to understand the weather information I get before flights.	X		
19	You should decide quickly and then make adjustments later.		X	
20	It is very unlikely that a pilot of my ability would have an accident.	X		
21	I fly enough to maintain my proficiency.	X		
22	I know how to get help from ATC if I get into trouble.	X		
23	There are few situations I couldn't get out of.	X		
24	If you don't push yourself and the aircraft a little, you'll never know what you could do.		X	
25	I often feel stressed when flying in or near weather.	X		
26	Sometimes you just have to depend on luck to get you through.		X	
27	Speed is more important than accuracy during an emergency.		X	

Individual questions are aggregated into the above three categories. To offer a more complete analysis, for this research, six demographic variables were included with the survey. Age, Gender, Highest Level of Certification, Possession of an Instrument Rating, Total Flying Time, and Flight Time in the Previous 90 Days were included. Rather than simply analyze the aggregated data as one large sample, including these variables allowed for more-specific analysis where differences existed within the three hazardous areas.

Limitations

The population was limited to students enrolled in UAA flight school programs. Participants were volunteers who agreed to share their time and attitudes about different aspects of safety. While purposeful, these responses may, or may not, be representative for students at non-UAA flight schools.

Results

General Attributes

Six variables were included: Age, Gender, Highest Level of Certification, Possession of an Instrument Rating, Total Flying Time, and Flight Time in the Previous 90 Days. For the *Age* variable, 94% were between the ages of 18-22 years and 6% were between the ages of 23-27 years. For the *Gender variable*, 74% identified as Male, 25 identified as Female, and 1% did not identify a gender. For the *Highest Level of Certification* variable, 68% were Private pilots and 32% were Student pilots. For the *Possession of an Instrument Rating* variable, 28% possessed an instrument rating while 72% did not possess an instrument rating. For the *Total Flying Time* variable, 15% had fewer than 25 hours, 8% had 25-50 hours, 12% had 51-75 hours, 8% had 76-100 hours, 33% had 101-150 hours, 14% had 151-200 hours, and 22% had 201-250 hours. For the *Flight Time in the Previous 90 Days* variable, 14% flew 1-10 hours, 47% flew 11-25 hours, and 39% flew 26-50 hours. See Figure 1 for individual question results.

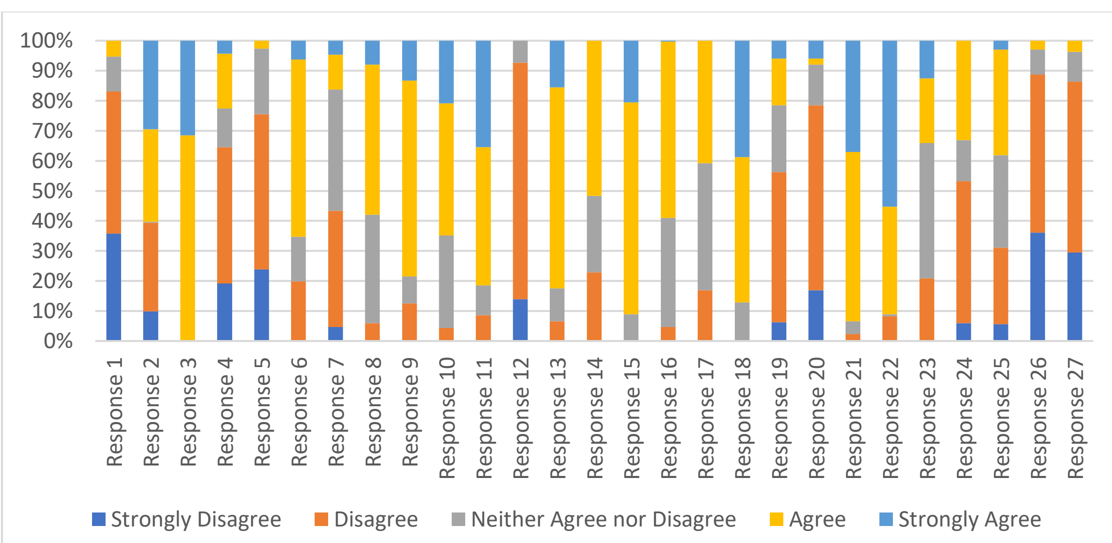


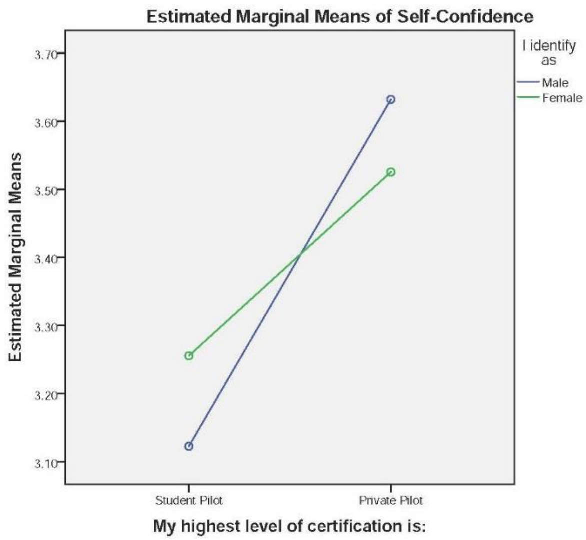
Figure 1. Individual question results. Please see actual survey questions located in the reference section.

Although there were small differences among respondents on each question, pairwise comparisons showed statistically significant differences in three areas:

Self-Confidence

Within *Self-Confidence*, differences were noted in gender and type of pilot certification.

The Gender by Certification interaction on Self-Confidence was overall significant, *F*(1,294)=10.324, *p*=.01. Among student pilots, female pilots scored higher on Self-Confidence (*M*=3.256, *SE*=.039) than male pilots (*M*=3.123, *SE*=.036), *p*=.014. Among private pilots, male pilots scored higher on Self-Confidence (*M*=3.632, *SE*=.02) than female pilots (*M*=3.525, *SE*=.049), *p*=.04. Please see Figure 2.



Pairwise Comparisons					
Dependent Variable: Self-Confidence					
I identify as	My highest level of certification is	My highest level of certification is	Mean Difference	Std Error	Sig.
Male	Student Pilot	Private Pilot	-.509*	.042	.000
	Private Pilot	Student Pilot	.509*	.042	.000
Female	Student Pilot	Private Pilot	-.207*	.062	.000
	Private Pilot	Student Pilot	.207*	.062	.000

*The mean difference is significant at the .05 level

Univariate Tests

Dependent Variable: Self-Confidence

I identify as		Sum of Squares	df	Mean Square	F	Sig.
Male	Contrast	10.462	1	10.462	149.346	.000
	Error	20.596	294	.070		
Female	Contrast	1.336	1	1.336	19.071	.000
	Error	20.596	294	.070		

Each F tests the simple effects of My highest level of certification is: within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Tests of Between-Subjects Effects

Dependent Variable: Self-Confidence

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12.984[a]	3	4.328	61.779	.000
Intercept	2311.316	1	2311.316	32993.046	.000
GENDER	.009	1	.009	.125	.723
CERTIFICATION	7.656	1	7.656	109.288	.000
GENDER * CERTIFICATION	.723	1	.723	10.324	.001
Error	20.596	294	.070		
Total	3628.791	298			
Corrected Total	33.580	297			

a. R Squared = .387 (Adjusted R Squared = .380)

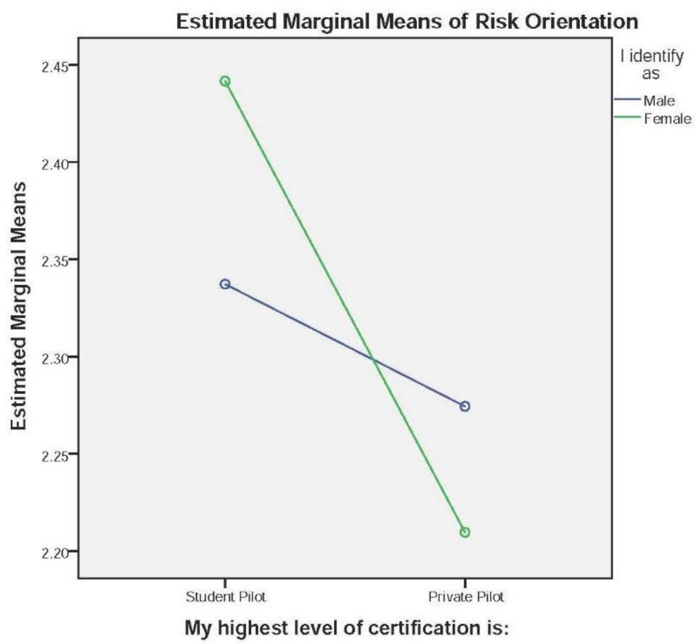
Figure 2. Differences noted between gender and type of pilot certification within the category of Self-Confidence.

Therefore, $H1_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Self-Confidence, is rejected.

Risk Orientation

Within *Risk Orientation*, differences were noted in gender and type of pilot certification.

The Certification by Gender integration on Risk Orientation was overall statistically significant, $F(1,294)=4.48$, $p=.035$. Female student pilots scored higher on Risk Orientation ($M=2.442$, $SE=.042$) than female private pilots ($M=2.21$, $SE=.051$), $p=.001$. Among the female pilots, there was a difference between the attitudes of student pilots and private pilots. Please see Figure 3.



Pairwise Comparisons					
Dependent Variable: Risk Orientation					
I identify as	My highest level of certification is	My highest level of certification is	Mean Difference	Std Error	Sig.
Male	Student Pilot	Private Pilot	.063	.045	.161
	Private Pilot	Student Pilot	-.063	.045	.161
Female	Student Pilot	Private Pilot	.232*	.066	.001
	Private Pilot	Student Pilot	-.232*	.066	.001

*The mean difference is significant at the .05 level

Univariate Tests

Dependent Variable: Risk Orientation

I identify as		Sum of Squares	df	Mean Square	F	Sig.
Male	Contrast	.159	1	.159	1.979	.161
	Error	23.683	294	.081		
Female	Contrast	.988	1	.988	12.263	.001
	Error	23.683	294	.081		

Each F tests the simple effects of My highest level of certification is: within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Tests of Between-Subjects Effects

Dependent Variable: Risk Orientation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.335[a]	3	.445	5.525	.001
Intercept	1082.484	1	1082.484	13438.023	.000
GENDER	.020	1	.020	.246	.620
CERTIFICATION	1.097	1	1.097	13.615	.000
GENDER * CERTIFICATION	.361	1	.361	4.480	.035
Error	23.683	294	.081		
Total	1607.078	298			
Corrected Total	25.018	297			

a. R Squared = .053 (Adjusted R Squared = .044)

Figure 3. Differences noted between gender and type of pilot certification within the category of Risk Orientation.

Therefore, $H2_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Risk Orientation, is rejected.

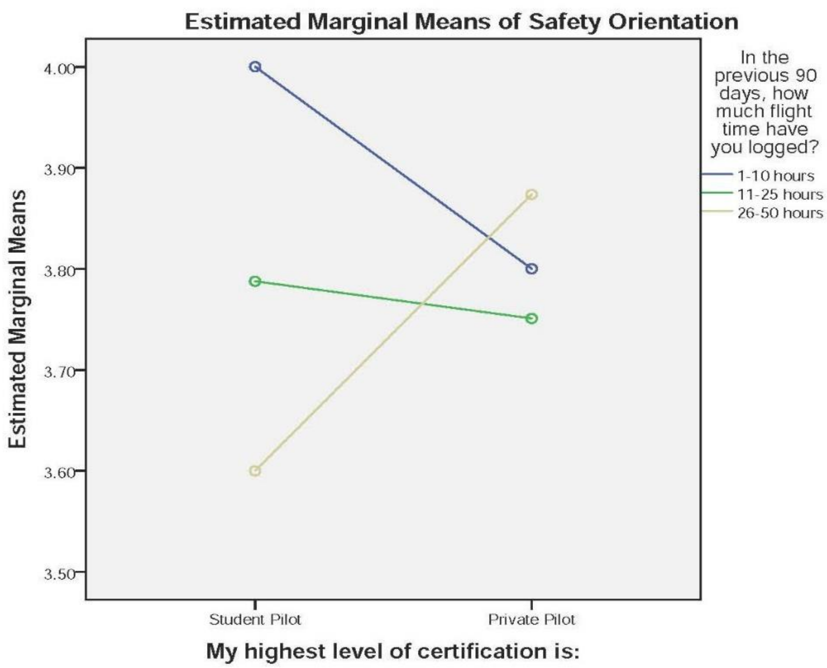
Safety Orientation

Within *Safety Orientation*, differences were noted in the number of hours flown within the past 90 days and type of pilot certification.

The Certification by Number of hours flown in previous 90 days interaction on Safety Orientation was overall statistically significant, $F(2,296)=6.333$, $p=.002$. Among student pilots, there was no difference between 1-10 and 11-25 hours, but there were statistically significant differences between 1-10 and 26-50 hours as well as 11-25 and 26-50 hours. Among Private pilots, there were no statistical differences between 1-10 hours and 11-25 hours, nor 1-10 and 26-50 hours, but there were statistically significant differences between 11-25 and 26-50 hours. Please see Figure 4.

Pairwise Comparisons					
Dependent Variable: Safety Orientation					
My highest level of certification is	In the previous 90 days, how much flight time have you logged?	In the previous 90 days, how much flight time have you logged?	Mean Difference	Std Error	Sig.
Student Pilot	1-10 hours	11-25 hours	.212	.131	.105
		26-50 hours	.400*	.151	.008
	11-25 hours	1-10 hours	-.212	.131	.105
		26-50 hours	.188*	.088	.033
	26-50 hours	1-10 hours	-.400*	.151	.008
		11-25 hours	-.188*	.088	.033
Private Pilot	1-10 hours	11-25 hours	.049	.059	.406
		26-50 hours	-.074	.054	.175
	11-25 hours	1-10 hours	-.049	.059	4.06
		26-50 hours	-.123*	.046	.007
	26-50 hours	1-10 hours	.074	.054	.175
		11-25 hours	.123*	.046	.007

*The mean difference is significant at the .05 level



Univariate Tests

Dependent Variable: Safety Orientation

In the previous 90 days, how much flight time have you logged?		Sum of Squares	df	Mean Square	F	Sig.
1-10 hours	Contrast	.176	1	.176	2.193	.140
	Error	23.786	296	.080		
11-25 hours	Contrast	.047	1	.047	.587	.444
	Error	23.786	296	.080		
26-50 hours	Contrast	.807	1	.807	10.041	.002
	Error	23.786	296	.080		

Each F tests the simple effects of My highest level of certification is: within each level combination of the other effects shown. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

Tests of Between-Subjects Effects

Dependent Variable: Safety Orientation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.395[a]	5	.279	3.471	.005
Intercept	1493.085	1	1493.085	18580.271	.000
TOT_FLYING_90	.343	2	.171	2.131	.120
CERTIFICATION	.004	1	.004	.048	.826
TOT_FLYING_90 * CERTIFICATION	1.018	2	.509	6.333	.002
Error	23.786	296	.080		
Total	4404.320	302			
Corrected Total	25.181	301			

a. R Squared = .055 (Adjusted R Squared = .039)

Figure 4. Differences noted between the number of hours flown within the past 90 days and type of pilot certification within the category of Safety Orientation.

Therefore, $H3_0$: There is no significant difference in hazardous attitudes reported by UAA students based on the six attributes stated above within the area of Safety Orientation, is rejected.

Discussion

There are three areas of statically significant differences for discussion. Each of the three hazardous orientations showed one area of statistically significant differences.

Safety Orientation

Regarding their flight time within the past 90 days, this indicates student pilots who flew the least (1-10 hours) had a higher safety orientation than student pilots who flew more hours

(26-50 hours). Although there were differences in private pilot safety orientation, their differences were much smaller. One probable reason for the differences is that it is quite possible that student pilots who fly less frequently are less comfortable in an airplane, therefore have a higher safety orientation than student pilots who fly more often. Student pilots, who fly more (26-50 hours), have quickly built a basic flying routine, and are more comfortable in the early part of training. As a pilot goes further into training and earns a private pilot's license, the safety orientation increases in every category. Finally, for private pilots, those who flew the most (26-50 hours) had the highest safety orientation (although there were no statistically differences among the private pilot responses).

Risk Orientation

This indicates that female student pilots had a higher risk orientation than female private pilots. Although there were some differences in male student and private pilot risk orientation, their differences were not statistically significant differences From this sample, females had a lower risk orientation (were willing to take on more risk) as they gained more experience. It is possible that as females gained more experience, their perception of the severity of risk decreased. There is always risk in aviation; pilots should be taught to manage risk to acceptable levels. Another possible reason is that, within the sample, the student pilots may have been extremely cautious and, once gaining confidence and certificated as a private pilot, were willing to take more risks and/or reevaluate situations as a lower risk factors than earlier perceived.

Self-Confidence

Overall, self-confidence increase for both males and females as they became private pilots. Males started off with a higher initial score, so the change in their mean score was not as pronounced as the increase in the female's mean score. Sundheim (2013) and Gerdemen (2019) discussed different theories on self-confidence differences in males and females, both noting females, overall, tend to have lower self-confidence. Interestingly, Northwestern Mutual (2017 conducted a financial analysis where females tended to have lower self-confidence than males, but once comfortable in a situation, increased their self-confidence tremendously. This could be a similar situation, both for self-confidence and the previously discussed risk orientation.

Moreover, this also correlated to the driving study conducted by Wayne and Miller (2018). The authors recruited one hundred novice drivers, 50 females and 50 males, who were instructed and evaluated by the same driving instructor. Initially, females were significantly less self-confident in their driving skills than males ($p > .001$), even though there were no gender differences in driving skill rating by the instructor. By the end of the training, there was no difference in male and female self-confidence rating. The authors noted that "female drivers' confidence was positively correlated with hours behind the wheel prior to the lesson—the more hours behind the wheel, the more self-confident the female driver" (Wayne & Miller, 2018, p. 2). Finally, the results of this research are also in agreement with Furedy's (2019) assessment of gender differences in attitude.

Other Considerations

The ASAS is a foundational assessment for determining hazardous attitudes within aviation, however, it is becoming outdated. The ASAS was developed at a time when most aircraft systems were manually controlled. Since the time the ASAS was developed, many fight school use aircraft with autopilots, weather radar, automatic dependent surveillance-broadcast systems, terrain and collision avoidance systems, and many other high-tech devices to assist the pilot. These newer systems may influence the hazardous attitudes first envisioned by Hunter. Although the ASAS is a reliable instrument, and the same five hazardous attitudes are still the foundation of aeronautical decision making, the instrument should include more-advanced concepts such as crew resource management and single-pilot resource management. Newer assessments need to be developed to represent the current environment, including over-reliance on automation and technology, accuracy and displays of different types of weather radar, amount of time spent “heads down” programing computers.

Being associated with a college or university, UAA flight schools tend to have more formalized curriculum and training than is required of private flight schools. The attitudes instilled in a more-structured UAA curriculum may not be representative of independent flight schools. Moreover, although the sample size was sufficient for this research, future studies should include a larger sample size. Since pilots from both UAA and independent flight schools share the sky, it is critical to understand the attitudes of all pilots.

The research question was:

Do UAA flight school students exhibit similar levels of hazardous attitudes, based on the attributes of age, gender, highest level of certification, possession of an instrument rating, total flying time, and flight time, while in flight school training?

As is determined from the analysis, there are statistically significant differences in each of the three areas--Self-Confidence, Risk Orientation, and Safety Orientation--however, only one instance was noted for each area. This indicates that UAA flight school students do exhibit similar levels of hazardous attitudes. Overall, UAA flight school students do share similar views on hazardous attitudes.

Conclusions

Safety attitudes and awareness are a part of every UAA flight school curriculum. The ASAS is one indicator of potentially hazardous attitudes expressed by low-time pilots. Results of this survey showed that, in general, UAA flight school students exhibit similar levels, to each other, of hazardous attitudes while in flight school training, indicating flight schools are successful in helping instill a safety culture within their students. Areas of some differences in Self Confidence, Risk Orientation, and Safety Orientation give us opportunities to create safer attitudes among low-time pilots. There are, however, opportunities for instructors to better understand their student’s potentially hazardous attitudes by asking specific questions about their safety orientation, risk orientation, and self-confidence.

Recommendations

There are three areas for flight school instructors and curriculum designers to consider emphasizing in training. First, attitudes should be verbalized as part of the pre-flight briefings. An instructor cannot "know what is inside someone's head," so the most practical way to understand a pilot's attitude is to discuss it. Each lesson's curriculum should dedicate time for the pilot to talk about what aspects of the flight he/she is getting comfortable with and where there is concern. A high safety/risk orientation is desirable, but never to the point of becoming unable to complete the mission. Risk is part of aviation, so pilots need to understand and appropriately manage risk. Second, as a pilot gains additional experience, self-confidence should also increase. The instructor should monitor and acknowledge an appropriate increase in self-confidence. Students should display an appropriate increase in confidence to ensure correct decisions are made, however, this increase needs to be monitored to prevent over-confidence, which can lead to recklessness. One technique is for instructors to emphasize the building-block approach, emphasizing how the next phase of training builds on the good judgement and decision making already demonstrated by the pilot. Third, understand that there may be initial differences in male and female self-confidence. If so, this is considered a normal event. Training for instructors should include information on appropriate increases in self-confidence. More flight time and more opportunities to express good decision making should lead to higher self-confidence.

There are also three recommendations for future research. First, continue to investigate and create attitude assessments that better reflect the current environment and capabilities of flight training. Assessments that include current technology, such as weather radar, hand flying verses using the autopilot, and heads-down orientation versus actively looking outside the aircraft need to be included to get a realistic understanding of current pilots. Although Hunter's ASAS is a foundational document, it may not provide an accurate assessment of the current environment. Next, research should be conducted, with larger samples, to better assess differences, if any, of female pilots. Although studies have shown differences, larger samples sizes should be used to further validate these findings. Finally, these studies should be replicated across all flight schools, not just the UAA flight schools, to create a better understanding of possible systemic changes that need to be made. Studies should be replicated at regular intervals to assess hazardous attitudes and allow instructors and curriculum designers the ability to update their training programs based on current needs. Understanding student and private pilot attitudes allows instructors and curriculum designers better opportunities to continually reinforce safe attitudes.

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Appendix - Aviation Safety Attitude Scale

ItemNumber	Question
1	I would duck below minimums to get home.
2	I am capable of instrument flight.
3	I am a very careful pilot.
4	I never feel stressed when flying.
5	The rules controlling flying are much too strict.
6	I am a very capable pilot.
7	I am so careful that I will never have an accident.
8	I am very skillful on controls.
9	I know aviation procedures very well.
10	I deal with stress very well.
11	It is riskier to fly at night than during the day.
12	Most of the time accidents are caused by things beyond the pilot's control.
13	I have a thorough knowledge of my aircraft.
14	Aviation weather forecasts are usually accurate.
15	I am a very cautious pilot.
16	The pilot should have more control over how he/she flies.
17	Usually, your first response is the best response.
18	I find it easy to understand the weather information I get before flights.
19	You should decide quickly and then make adjustments later.
20	It is very unlikely that a pilot of my ability would have an accident.
21	I fly enough to maintain my proficiency.
22	I know how to get help from ATC if I get into trouble.
23	There are few situations I couldn't get out of.
24	If you don't push yourself and the aircraft a little, you'll never know what you could do.
25	I often feel stressed when flying in or near weather.
26	Sometimes you just have to depend on luck to get you through.
27	Speed is more important than accuracy during an emergency.