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Gender Differences and their Relation to Hazardous Attitudes in Pilot Training

Matthew D. Furedy
University of Central Missouri

It has been stated by the Federal Aviation Administration (FAA) that Aeronautical Decision Making (ADM) training for pilots has been effective in reducing in-flight errors by up to 50 percent. Hazardous attitudes and their associated antidotes are currently discussed as part of the FAA's ADM training for pilots. The purpose of this study is to add to the understanding of decision making differences and the effectiveness of instructing students on mitigating hazardous attitudes throughout their pilot training programs, in both male and female students using the New Hazardous Attitudes Survey. Results of this study discovered that only two of the six hazardous attitudes, Resignation and Self Confidence, were significantly lower in students who had advanced levels of flight training, as compared to those with only basic levels. Another significant result demonstrated that female's overall hazardous attitudes scores were higher in the more advanced levels of flight training while males scores were lower.

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A significant amount of aviation safety related research tends to focus in such research parameters as pilot age, training, and flight hours. In addition to these traditional "characteristics", could there be gender related factors that may be generalized to the pilot population as well? In March of 2015, well-known aviation educator, John King, wrote an article entitled "Sky Kings: Learning to fly like a girl." While there are negative connotations associated with the phrase "…like a girl", in this article King posits that female pilots may be less disposed to unsafe behaviors and personality traits than their male counterparts. This article referred to a Civil Aviation Authority report ("Safey Skies," 1995) that studied accidents over a ten-year period. The study found that male pilots were four times more likely to be involved in an accident than their female counterparts (King, 2015).

According to a report on general aviation accidents conducted by the Airport Owners and Pilots Association (AOPA), accidents caused by pilot error accounted for 75.3% of the total number of accidents and 75.0% of all accidents that involved a fatality (2015). As aviation's leading cause of accidents, there is an ever increasing number of studies that focus on finding effective mitigations for pilot error that, in turn, could potentially reduce the rate of occurrence. Research relating to safety and gender-based differences poses a challenge because of the relatively small percentage of female pilots. In 2012, women made up only 4.3% of certificated pilots (AOPA, 2015).

The suggestion from King (2015) that females might be safer pilots is supported by relevant research, such as Vail & Ekman (1986) and the study conducted in 1995. These findings are contradicted, in part, by other studies (Bazargan & Guzhva, 2011). Should measurable differences be identified by future studies? The question becomes "what gender-related characteristics allow female pilots to avoid involvement in accidents to the extent, or severity, that male pilots are"? Are there better ways to deliver flight education that leverages the differences between the behavioral tendencies of two genders?

Literature Review

Impact of Gender on General Aviation Accidents

The differences in the severity of accidents may be due to females listening to rules and regulations concerning how to stay alive. While direct comparisons between automobile drivers and pilots are not appropriate it is interesting to note the general compliance males and females have toward safety programs. Waldron, McClosky and Earle (2005) concluded that females had more of a tendency to comply with rules and procedures, and to favorably regard legal campaigns such as those addressing the use of seatbelts and the avoidance of driving while intoxicated.

According to a Swedler, Bowman, & Baker (2012) study conducted at the Johns Hopkins School of Public Health, it might have less to do with the number of accidents and more to do with the fact that males are more likely to be involved in fatal accidents:

> A total of 14,026 teen drivers were involved in 5,408 fatal crashes in 2007, 4,459 fatal crashes in 2008, and 4,159 fatal crashes in 2009. Of these 14,026 drivers, 6,261 were killed in the crash (45%). Males comprised 69% of teen drivers involved in fatal crashes, with slight variation for each age. (p. 98)

In comparison, studies have identified male pilots being involved in significantly more fatal accidents. Vail and Ekman (1986) found that males were twice as likely to be involved in a fatal accident. A study conducted by the Civil Aviation Authority ("Safer skies," 1995) stated the difference was four times more likely. Finally, a study by Bener et al. (2013) placed the odds of male pilots being involved in a fatal accident at three times that of their female counterparts.

A study by Bazargan and Guzhva (2011) concluded that instead of gender being the contributing difference in fewer fatal accidents, it is more likely that age is the deciding factor. Their reasoning is that pilots over the age of 60 grow increasingly more likely to be involved in an accident. The authors support this theory by referencing the reduced differences between genders in fatal accident rates shown between the first sample period (1983 – 1992) and the second sample period (1993 – 2002) suggesting that as the average age of female pilots increases so will the rate of fatal accidents (Bazargan & Guzhva, 2011).

Decision-Making Based on Risk Avoidance

The level of risk that men and women are willing to take on has been related in previous studies to how they display aggression (Fiengold, 1994; Maner et al., 2007). Thus, risk aversion differences between genders is another area to be explored when looking at factors that impact accident rates and accident severity. Could it be that differences in aggression and decision making styles develop out of differences in risk aversion?

As mentioned by Moffitt (2010), other studies have indicated that there is a tendency for women to avoid harmful or risky behavior. Waldron et al. (2005) showed that male pedestrians are 80% more likely to be involved in an accident then women pedestrians. Feingold (1994) found that females show a higher tendency towards anxiety than males, according to Maner et al. (2007), which relates to a low proclivity to take risks and may also be associated with an amplified pessimistic risk appraisal.

Emotions serve as relevant forms of information, signaling the presence of particular threats to be avoided or rewards to be acquired. Emotions, in turn, promote cognitive responses facilitating the avoidance of threat and the acquisition of rewards. "With respect to decision-making, some emotions (e.g., anger) promote decision-making biases that increase one's tolerance for risk, whereas other emotions (e.g., disgust) promote decision-making processes associated with risk-avoidance" (Maner et al., 2007, p. 666).

Maner et al. (2007) also indicates a link between anxiety and risk-avoidant decision-making, both of which were shown to be traits more prevalent in females. Harris, Jenkins, and Glaser (2006) found evidence to the contrary, suggesting the notion that women avoid risk due to pessimistic thoughts was incorrect. Harris et al. (2006) also described a more evolutionary explanation for why women preferred to take part in fewer risk related activities. According to Harris et al. (2006), this theory suggested that perhaps:

> Women have a tendency to see greater risks than men see, not because of different selection pressure relating to mate seeking, but rather because if one perceives more risks in the world, one will be more effective at keeping safe any offspring under one's care. (p. 60).

A link between a pilots' tolerance for risk and their behavior with regard to safety during a flight was shown by Wetmore and Lu (2006). Ji, You, Lan, & Yang, S. (2011) stated that this "shows pilots' hazardous attitude plays an important role in the relationship between risk tolerance and safety operation behavior, in which risk tolerance may directly influence hazardous attitude, and, in turn, may directly influences the safety operation" (p. 1413). The results of the 2011 research supported this, finding that pilots who had tendencies toward higher levels of risk tolerance also showed a tendency toward hazardous attitudes and ignored standard procedures.

Hazardous Attitudes

The FAA's definition of hazardous attitudes lists five attitudes that can negatively affect a pilot's judgement during the decision making process: *macho, resignation, anti-authority, impulsivity*, and *invulnerability*. Lee and Park (2016) add to that by saying that hazardous attitudes can be defined as "a personal motivation tendency that affects an individual's ability to make good decisions" (p. 70). Just as the FAA stated that good judgment can be taught, Lee and Park (2016) note that hazardous attitudes can also be corrected through training. This educational process includes learning how to recognize personal attitudes and the dangers associated with them, and what further can be done to change those attitudes.

Holt et al. (1991) used a comparison between automobile drivers and pilots in order to create a larger sample size due to the greater number of automobile accidents as compared to aviation accidents. This allowed them to measure attitudes and accident rates and extrapolate to the larger population of pilots. The measurements for the Holt et al. (1991) study used a new instrument with nearly the same attitudes with one exception. By considering answers from the automobile surveys, the researchers found that there was one additional attitude that related to the drivers' confidence in their ability, which they titled the *Self-Confidence* hazardous attitude. This study also identified an additional, unexpected factor that represented *self-confidence*. The result of this identified a new set of six hazardous attitudes that included *Macho, Resignation, Antiauthority, Worry/Anxiety, Impulsivity*, and *Self-Confidence*.

Another effect of studying hazardous attitudes from the Holt et al. (1991) study was to improve the type of instrument being used to measure hazardous attitudes, the New Hazardous Attitudes Survey (New-HAS). While the results of the Holt et al. (1991) study focused on drivers, the instrument switched from the FAA's ipsative type instrument, which was included within their Aeronautical Decision Making training manuals, to one using a Likert Scale. Ipsative type surveys limited the subject's responses to either one or the other type of attitude, known as the *Forced Choice* method. By choosing one attitude over another, the ipsative scales cause unintentional de-emphasis of the other possible measurements.

Wetmore, Lu and Caldwell (2007) theorized that the reason 86% of fatal general aviation accidents involve hazardous attitudes as a contributing factor, even after years of education and awareness efforts, could be the way Certified Flight Instructors (CFI's) are conducting training. "The answer to this question may be that certain tenets and beliefs of the educational philosophies, ideologies, and theories permeating our educational system can actually exacerbate rather than ameliorate hazardous attitudes" (Wetmore, Lu, & Caldwell, 2007, p. 30). Their conclusion was that each CFI must continuously evaluate their teaching style and ask themselves whether their students possess any hazardous attitudes, identify each hazardous attitude their students may have and then evaluate their teaching style to determine whether it is either mitigating the hazardous attitudes or making it worse.

Methodology

This study utilized a quantitative methodology that analyzed differences between male and female pilots concerning their tendencies toward one or more of the hazardous attitudes that could facilitate unsafe decision-making in the flight deck. In attempting to address this issue, it was necessary to first identify a population of pilots that included both males and females, and then survey them using the New Hazardous Attitudes Scale. The New-HAS is a self-assessment instrument used to assist pilots in assessing and understanding their own tendencies. This instrument was developed for previous studies and this variation presents 88 simple declarative statements with a five-point Likert-type response scale.

Analysis of the New-HAS was conducted by Hunter (2005) and produced six-factors that corresponded to the same factors detailed by Holt et al. (1991) which included *Macho, Resignation, Antiauthority, Anxiety/Worry, Impulsivity*, and *Self-Confidence*. The questions corresponding to these Hazardous Attitudes factors, developed by Hunter (2005), are detailed in Appendix A.

Research Hypotheses

In this study, the authors aimed to clarify the effect of gender and training on a student's tendencies toward hazardous attitudes. The corresponding research hypotheses are as follows:

Hypothesis 1. Overall, females score lower on hazardous attitudes inventories than do males.
Hypothesis 2. As flight training levels advance, hazardous attitudes will decrease for both genders.
Hypothesis 3. Overall, the Hazardous Attitudes *Macho* and *Resignation* will be more prevalent in inventory scores than the other attitudes.
Hypothesis 4. As training levels advance, females will score lower overall on hazardous attitudes than do males.

Data Analysis

Data analysis was performed using IBM's Statistical Package for the Social Sciences (SPSS) statistics program version 25. Prior to testing the hypotheses, an Overall Hazardous

Attitudes score was computed as the average of the six New-HAS scales. All seven scales were assessed for normality using *z*-scores formed by dividing skewness values by the standard error of skewness (*SK/SE*). Hypotheses 1 and 2 were analyzed using independent samples *t*-tests. Hypothesis 3 was tested by first computing an Overall Hazardous Attitudes score, excluding the *Macho* scale, and another Overall score excluding the *Resignation* scale. Then paired *t*-tests were used to compare the *Macho* scale to the average of the other five scales and the *Resignation* scale to the average of the remaining five scales. Hypothesis 4 was tested using two-by-two analyses of variance (gender by training level) on the six Hazardous Attitude scales as well as the Overall Hazardous Attitudes score. A multivariate analysis of variance (MANOVA) of the six Hazardous Attitude scales was also computed. An alpha of .05 was accepted as the level of significance.

Participants

The New-HAS was provided to 208 students in eight classes from two universities with Part 141 flight schools located within the Midwest region of the United States over a six month period between March and September 2017. In total, 23 of the surveys were returned at the end of the allotted time-frame unanswered, which resulted in an 88.9% response rate. The final sample of 185 students were over the age of 18, and included 26 females (14.1%), which is above the 2012 national average of 4.3% (AOPA, 2015). Due to the relatively small size of the sample--especially the female portion of the sample--the five levels of training that were included in the questionnaire were instead grouped together into two groups including basic level of flight training (student pilot & private pilot) and advanced flight training (instrument, commercial, and Certified Flight Instructors).

Limitations listed here represent potential weaknesses and include items that are mostly out of the control of the researcher. The identified limitations of this study include the limited number of collegiate flight schools that accepted the request to survey students. The participating schools were located in Missouri and Tennessee and the participants were enrolled in a private, instrument, or commercial ground course. This led to a reduced number of classrooms and number of participants representing each population.

G*Power indicates total sample size of 128 is needed to achieve power of 0.80 for a medium size effect for *t*-tests and *F*-tests. G*Power also indicated that MANOVA would have needed a sample size of 226 to achieve a power of 0.80. However, the MANOVA did not yield a significant difference.

Hypothesis Testing

<u>Hypothesis 1</u>: This hypothesis was tested by first computing an Overall Hazardous Attitudes score, as the average of the six Hazardous Attitude scales. Then, an independent samples *t*-test was conducted between males and females on the Overall score as well as for the individual Hazardous Attitude scales. The results are presented in Table 1.

Table 1

Males vs. Females on Hazardous Attitudes scales

	Females (n = 26)		Males (n = 159)				
	Mean	*SD*	*Mean*	*SD*	*t*	*df*	*p*
Macho	**2.46**	**0.56**	**2.75**	**0.55**	**-2.47**	**183**	**0.015**
Resignation	2.19	0.48	2.28	0.53	-0.79	183	0.433
Anti-Authority	2.02	0.45	2.14	0.44	-1.27	183	0.205
Anxiety/Worry	3.13	0.56	2.95	0.48	1.64	183	0.104
Impulsivity	2.39	0.46	2.51	0.43	-1.25	183	0.212
Self Confidence	3.74	0.44	3.78	0.47	-0.37	183	0.712
Overall Attitude	2.66	0.21	2.73	0.23	-1.62	183	0.107

Note. Scale showing a statistically significant difference is indicated in bold.

As shown, female scores were not significantly lower than male scores on the Overall Attitude score. This result does not support acceptance of Hypothesis 1. However, there was a significant difference in the scores for females (*M*=2.46, *SD*=0.56) and males (*M*=2.75, *SD*=0.55) on the *Macho* subscale: $t(183) = -2.47$, $p = .015$. The tendency for females to exhibit significantly lower scores of the *Macho* hazardous attitude confirms the findings previously identified by Holt et al. (1991) and Hunter (2005).

The sizes of groups compared in this study, such as those between female and male pilots are acknowledged as being unequal. According to Nolan and Heinzen (2017) if sample sizes are unequal, then the statistical test is generally valid as long as the largest variance is not more than twice the size of the smallest variance. Levenes's tests were conducted on all *t*-tests, *F*-tests, and MANOVA to assess the equality of variances between the groups. These tests indicated there was no violation of homogeneity of variances.

Hypothesis 2: This hypothesis was tested by conducting independent samples *t*-tests between those with basic flight training and those with advanced flight training on the six Hazardous Attitude scales as well as the Overall Hazardous Attitudes score. The results are presented in Table 2.

Table 2

Basic vs. advanced flight training on Hazardous Attitudes scales

	Flight Training						
	Basic (n = 139)		Advanced (n = 46)				
	Mean	*SD*	*Mean*	*SD*	*t*	*df*	*p*
Macho	2.69	0.57	2.75	0.50	-0.65	183	0.516
Resignation	**2.33**	**0.50**	**2.08**	**0.53**	**2.90**	**183**	**0.004**
Anti-Authority	2.14	0.45	2.08	0.44	0.80	183	0.426
Anxiety/Worry	2.97	0.48	2.99	0.55	-0.18	183	0.855
Impulsivity	2.50	0.41	2.47	0.50	0.37	183	0.712
Self Confidence	**3.82**	**0.45**	**3.64**	**0.47**	**2.28**	**183**	**0.024**
Overall Attitude	2.74	0.24	2.67	0.21	1.88	183	0.062

Note. Scales showing a statistically significant difference are indicated in bold type.

As shown, students with advanced training (*M*=2.67, *SD*=0.21) had slightly lower overall attitude scores, although the difference between their scores and those of the students with basic training (*M*=2.74, *SD*=0.24) did not achieve statistical significance: $t(183) = 1.88$, $p = .062$. However, two of the six Hazardous Attitudes scales were significantly lower in the students who had advanced training. There was a significant difference in the scores for the *Resignation* hazardous attitude for basic flight training (*M*=2.33, *SD*=0.50) and advanced flight training (*M*=2.08, *SD*=0.53); t (183) = 2.90, p =.004. There was also a significant difference in the scores for the *Self-confidence* hazardous attitude for basic flight training (*M*=3.82, *SD*=0.45) and advanced flight training (*M*=3.64, *SD*=0.47); t (183) = 2.28, p =.024.

Hypothesis 3: This hypothesis was tested by first computing an Overall Hazardous Attitudes score excluding the Macho scale, and another overall score excluding the *Resignation* scale. Then paired *t*-tests were used to compare the *Macho* scale to the average of the other scales and the *Resignation* scale to the average of the remaining scales. The results are presented in Table 3.

As shown, there was no difference in the degree to which the participants scored on the *Macho* scale as compared to all other scales combined. However, the *Resignation* scale was significantly lower than the mean of all other scales combined. These results support rejection of Hypothesis 3, since no significant difference was found for the *Macho* scale and *Resignation* was actually significantly lower, rather than higher than the average of the other scales combined.

Table 3

Macho and Resignation scales vs. other scales

	Scale		Overall Without Scale		Difference				
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*t*	*df*	*p*
Macho	2.70	0.56	2.73	0.24	-0.02	0.57	-0.54	184	0.589
Resignation	**2.27**	**0.52**	**2.82**	**0.22**	**-0.55**	**0.48**	**-15.38**	**184**	**< .001**

Note. Scale showing a significant difference is indicated in bold type.

Hypothesis 4: This hypothesis was tested using a two-by-two analyses of variance (gender by training level) on the six Hazardous Attitude scales as well as the Overall Hazardous Attitudes score. The results are presented in Table 4 and Table 5.

The MANOVA did not show overall significant differences by gender or training, but the interaction between gender and training was significant for the Overall Attitudes score. The interaction effect is illustrated in Figure 1.

Table 4

Gender by Training on Hazardous Attitudes scales

	Females/ Basic (n = 18)		Females/ Advanced (n = 8)		Males/ Basic (n = 121)		Males/ Advanced (n = 38)	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Macho	2.32	0.50	2.77	0.58	2.74	0.56	2.75	0.50
Resignation	2.24	0.48	2.09	0.50	2.34	0.51	2.08	0.54
Anti-Authority	1.94	0.50	2.20	0.25	2.17	0.43	2.06	0.46
Anxiety/Worry	3.11	0.46	3.17	0.78	2.95	0.49	2.95	0.49
Impulsivity	**2.28**	**0.41**	**2.64**	**0.49**	**2.53**	**0.41**	**2.44**	**0.51**
Self Confidence	3.82	0.43	3.57	0.44	3.82	0.46	3.65	0.48
Overall Attitude	**2.62**	**0.19**	**2.74**	**0.24**	**2.76**	**0.24**	**2.65**	**0.20**

The interaction effect indicates that hazardous attitudes were lower for females with basic training (*M*=2.62, *SD*=0.19) than for males with basic training (*M*=2.76, *SD*=0.24), but that females with advanced training (*M*=2.74, *SD*=0.24) had higher overall hazardous attitudes compared to the males with advanced training (*M*=2.65, *SD*=0.20); F = 4.76, p =.030. Table 11 also details a similar interaction effect for the Impulsivity scale, with females having more advanced training showing higher levels of impulsivity than males; F = 5.05, p =.026. The observed power and partial eta squared are shown in Table 11. These results support rejection of Hypothesis 4, since as levels of training advanced, females scored higher, rather than lower overall on hazardous attitudes than did males.

Table 5

Gender by Training on Hazardous Attitudes scales

ANOVAs	Gender				Training				Gender * Training			
	F	*p*	*Power*	η_p^2	*F*	*p*	*Power*	η_p^2	*F*	*p*	*Power*	η_p^2
Macho	2.49	0.116	0.35	0.01	3.21	0.075	0.43	0.02	3.15	0.078	0.42	0.02
Resignation	0.14	0.705	0.07	0.00	3.07	0.082	0.41	0.02	0.26	0.612	0.08	0.00
Anti-Authority	0.15	0.701	0.07	0.00	0.50	0.483	0.12	0.00	3.36	0.069	0.45	0.02
Anxiety/Worry	2.52	0.114	0.35	0.01	0.06	0.802	0.06	0.00	0.07	0.788	0.06	0.00
Impulsivity	**0.05**	**0.824**	**0.06**	**0.00**	**1.69**	**0.195**	**0.25**	**0.01**	**5.05**	**0.026**	**0.61**	**0.03**
Self Confidence	0.16	0.694	0.07	0.00	3.73	0.055	0.48	0.02	0.17	0.681	0.07	0.00
Overall Attitude	**0.28**	**0.601**	**0.08**	**0.00**	**0.02**	**0.883**	**0.05**	**0.00**	**4.76**	**0.030**	**0.58**	**0.03**
*MANOVA**	0.75	0.611			2.12	0.054			1.41	0.215		

Note. Scales showing significant differences are indicated in bold type.
* excludes the Overall scale

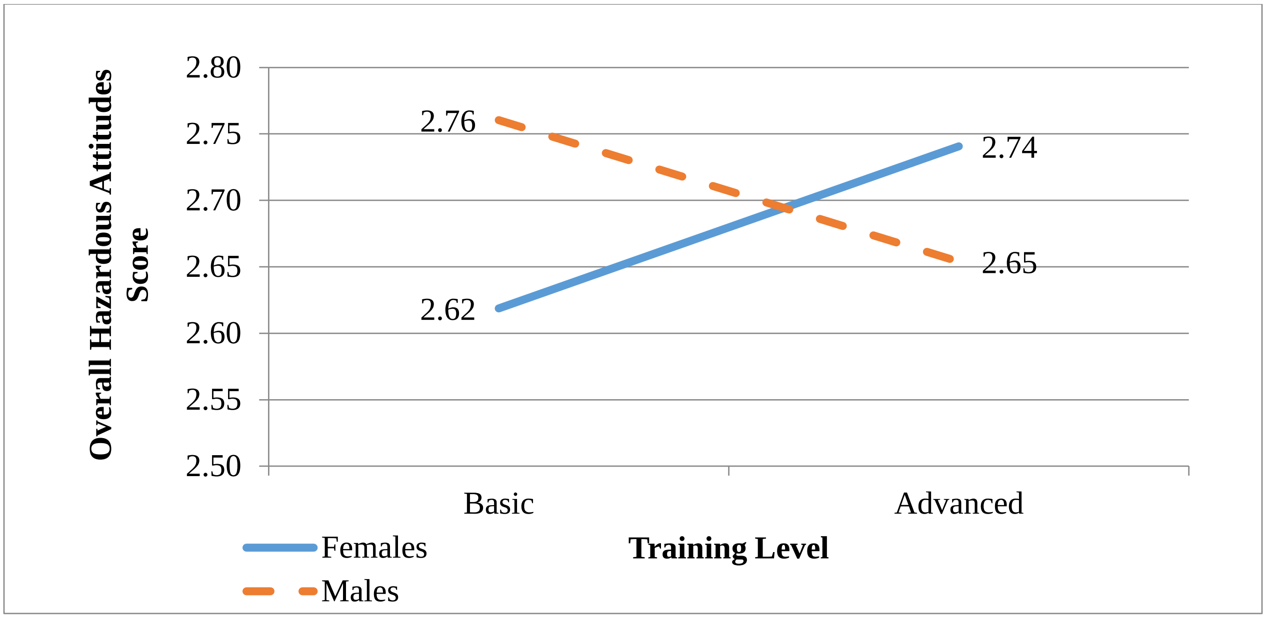

Figure 1. Gender by Training interaction effect on Overall Hazardous Attitudes

Findings and Conclusions

This study produced findings that suggest the possibility that previous research may not be generalizable or transferable between populations, regions, or timeframes. Population characteristics for this study limited the results to collegiate flight school students in their early 20's living in the Midwest region of the United States. Differences in these characteristics may have resulted in different results as suggested in previous literature. According to Reilly and Neumann (2013), societal factors can also modify the behavioral tendencies of young females to match those most acceptable to the norm.

Over the past decade, there have been campaigns throughout society to change the perceptions of what males and females should expect from gender. An example of one of these campaigns is the "Like a Girl" ad campaign conducted by Proctor & Gamble referenced by King (2015). These types of changes in what society perceives to be the norm could have an effect, over time, on the results of studies that address differences between genders.

Hypothesis 1 stated that overall, females will score lower on hazardous attitudes inventories than do males. According to the results from the New Hazardous Attitudes Scale, this hypothesis was not supported and the only significant finding confirmed previous studies results in which females demonstrated lower scores for the *Macho* hazardous attitude. While this finding confirms Holt et al. (1991) and Hunter (2005), it does not confirm that females demonstrated higher scores for the Resignation hazardous attitude.

Lester and Bombaci (1984) provide a possible explanation for the lack of *resignation* differences found in this study. They suggested that *resignation* should not normally be associated with pilots. A certificated pilot is required to spend a lot of time studying and training. This training, according to the authors, would eventually weed out any student who felt that their actions would not have an effect on the outcome, thus reducing the number who would demonstrate a high score in the *resignation* hazardous attitude.

Hypothesis 2 stated that as flight training levels advance, hazardous attitudes will decrease for both genders. The results support a partial acceptance of this hypothesis and potentially give support to the idea surrounding the effectiveness of collegiate flight programs in addressing hazardous attitudes to some degree. According to the results of this study, advanced flight students appear to exhibit slightly lower overall scores toward hazardous attitudes, especially *resignation* and *self-confidence* (when compared to basic flight students). The fact that the *resignation* and *self-confidence* hazardous attitudes exhibited lower scores in the advanced flight training suggests that advanced training provides some degree of mitigation to the decision-making abilities of students in stressful situations. As students progress through more advanced levels of flight education, the added skills and knowledge they acquire may be the reason they exhibit lower levels of *resignation* or *self-confidence*.

Hypothesis 3 stated that overall the hazardous attitudes *Macho* and *Resignation* will be more prevalent in inventory scores than the other attitudes. The results of this study indicated that the *Macho* hazardous attitude inventory presented lower scores for females and no significant difference for males. The *Macho* hazardous attitude exhibited no significant difference when compared with the average of the other scales. Conversely, the *Resignation* hazardous attitude did exhibit a significant difference when compared to the average of the other hazardous attitudes. Instead of being higher, the combined average was significantly lower. It was thought that since Holt et al. (1991) and Hunter (2005) did not separate results by training level or gender, that the results of this study would confirm their findings when each hazardous attitude was compared. Instead, only the finding on *macho* hazardous attitude was confirmed.

Hypothesis 4 stated that as training levels increase, females will score lower overall on hazardous attitudes than do males. It was believed that each of the hazardous attitudes would be partially mitigated through further flight training in both males and females. Previous literature suggested that females might be significantly safer overall than their male counterparts might, thus it was hypothesized that females might reduce their tendencies toward hazardous attitudes to a greater degree than males. Through the use of a MANOVA, the interaction between gender and training level identified a significant outcome in which females with advanced flight training had higher occurrences of hazardous attitudes, compared with males of the same level of flight training.

This study has implications in a variety of areas for collegiate flight schools at Midwestern universities. For collegiate flight school students, this study identifies areas where there may need to be more emphasis on determining learning preferences and what techniques may be more effective at reducing the presence of hazardous attitudes. For flight instructors, this study identifies potential successes and potential pedagogical pitfalls and how those may negatively impact both genders. A combination of factors might result in flight training better structured for males than for females. Females have attended and impacted the curriculum and training techniques of collegiate flight schools for a relatively short period of time as compared to males.

The results of this study indicate that the current instructional techniques or pedagogy are effective for males as they exhibited a decrease in their hazardous attitudes scores, while females exhibited a trend in the other direction. Identifying techniques for training populations of flight students who learn in different ways would potentially increase the effectiveness of learning beyond just the topic of hazardous attitudes, which could lead to safer and more knowledgeable pilots of both genders. The rise in overall hazardous attitudes scores for females should suggest to flight educational policy makers and associated stakeholders that they are not providing the female student pilots the same positive results, in regards to hazardous attitudes, as they are with their male student pilots. These results should provide a starting point for institutions determined to improve upon the instruction they provide to all students, which could result in the production of safer, better educated and more capable aviation professionals regardless of gender.

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Appendix A
Questions Corresponding to Hazardous Attitudes Factors (Hunter, 2005)

Table 1
Factor One questions from the New-HAS corresponding to the Macho Hazardous Attitude

Question	Factor Loading	Question Text
1	480	I'd like to be a bush pilot.
2	486	If there was a flying competition in my area, I'd participate in it.
3	755	I like to practice unusual attitudes in flying.
4	427	I like to see how close I can cut things.
5	409	I like landing on short fields just to show I can do it.
6	458	If gusty cross-winds were keeping other pilots on the ground, I'd consider flying anyhow to see if I could do it.
8	492	If I hear other pilots discussing a maneuver that can be done on my airplane, I'll try it out.
9	730	I like to practice spins.
10	430	I like to fly on the edge.
11	787	I like to practice unusual aircraft attitudes.
12	560	I like making turns steeper than 60 degrees, just to see if I can do it.
70	723	I like to practice stalls.
72	671	I like to practice steep turns.
73	485	If I find a sod (grass) field, I'll practice soft-field take off and landings.
74	514	When it's windy out, I like to work on my cross-wind landings.

Table 2.
Factor Two questions from the New-HAS corresponding to the Resignation Hazardous Attitude

Question	Factor Loading	Question Text
45	494	I might dip into my fuel reserve to avoid a fuel stop and save time.
46	436	Either an accident is going to happen to you or it isn't.
47	544	Sometimes I feel like the airplane has a mind of its own.
48	428	In a congested area, I figure that if I keep the correct altitude and heading I'll get through safely.
49	615	Sometimes I feel that I have very little control over what happens to the aircraft.
51	485	You don't go until your number is up.
52	401	I'll die when it's my time to go, but not before.
53	682	In a tight situation, I trust to fate.
54	625	When I'm in a tough spot, I figure if I make it, I make it, and if I don't, I don't.
55	522	If I think an accident is going to happen when flying, I tend to freeze at the controls.
56	531	If I had an accident, it would be the result of bad luck.
57	702	In flying, what will be, will be.
59	518	The strange noises in my airplane will just go away.

Table 3.
Factor Three questions from the New-HAS corresponding to the Antiauthority Hazardous Attitude

Question	Factor Loading	Question Text
61	752	The FAA is more of a hindrance than a help.
76	690	Air traffic control is often more of a hindrance than a help.
77	-530	In general, I get good service from Flight Service Stations.
79	-568	I will follow the FAA regulations even if they inconvenience me, because it's the right thing to do.
80	461	The FAA should do better things with their time than prosecuting pilots for minor airspace violations.
81	447	Random drug testing without any reason violates the rights of pilots.
83	-630	In general, I find ATC to be very helpful.
84	-629	FAA inspectors for GA are very competent.
86	630	Most of the Federal Aviation Regulations do not promote safety.
87	583	Ramp checks by FAA are a nuisance.
88	675	The FAA is more concerned with restricting access to aviation than in providing the services aviation needs.

Table 4.
Factor Four questions from the New-HAS corresponding to the Anxiety/Worry Hazardous Attitude

Question	Factor Loading	Question Text
13	464	I feel uncomfortable flying VFR in 3 miles visibility haze.
18	550	In an uncontrolled area with lots of traffic, I worry about the possibility of a mid-air collision.
19	-443	I feel comfortable flying at night.
20	636	I always worry about an accident when I'm flying.
21	636	I really worry about mid-air collisions.
22	630	While flying at night, I worry about not seeing navigation landmarks and getting lost.
23	617	I really worry about running out of fuel.
24	731	I really worry about having to make an emergency landing.
26	580	At night I worry about not being able to see an emergency landing field if the engine quits.
28	606	I feel very vulnerable to accidents.
30	623	If I fly over water, I worry about having to ditch if the engine quits.
31	409	If I'm on base leg and the wind shifts so I'd land with a tailwind, I'll go around to make a different approach.

Table 5.
Factor Five questions from the New-HAS corresponding to the Impulsivity Hazardous Attitude

Question	Factor Loading	Question Text
16	-542	If the weather is marginal, I don't mind waiting at the airport until it clears up.
33	695	I really hate being delayed when I fly on a trip.
34	417	I feel like yelling at people who don't clear the runway fast enough when I'm on final approach.
35	557	I'm basically an impatient pilot.
37	417	I get angry if I'm on approach on base leg and someone cuts in front of me doing a straight-in approach.
38	629	If I want to fly somewhere, I want to do it now.
43	441	If I could cut off a lot of time on a cross country flight by taking a short cut through an MOA, I'd do it.
82	574	If you want to protest a license suspension by the FAA, the odds are stacked against you.

Table 6.
Factor Six questions from the New-HAS corresponding to the Self-Confidence Hazardous Attitude

Question	Factor Loading	Question Text
51	409	You don't go until your number is up.
60	435	If I have done something illegal while flying, I will report it myself because I figure someone will report it anyway.
64	603	I am a pilot due entirely to my hard work and ability.
66	424	I can learn any flying skill if I put my mind to it.
68	407	In a tight situation, I believe in doing anything rather that doing nothing.
69	606	The thoroughness of my preflight mostly determines the likelihood of my having mechanical trouble with the aircraft.
78	529	A successful flight is solely due to good planning and good execution.