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Exploring Collegiate Flight Training Students' Perceptions of Safety Culture

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As flight training organizations expand and adapt to meet the growing demands of the industry, organizational leadership and safety departments are continuing to intensively focus on aviation safety and quality assurance through the core values of safety promotion, culture, and education. A flight school's safety culture, shaped by students' risk perceptions, can predict safety behaviors. Understanding students' trust and confidence in this safety culture could potentially aid in early risk mitigation strategies. The purpose of this study was to investigate flight students' perceived safety culture at a Title 14 Code of Federal Regulations (CFR) Part 141 flight training school in the Southeast region of the United States. The survey was adapted from the Safety Culture Indicator Scale Measurement System. Quantitative and qualitative data were obtained from 398 students. Confirmatory factor analysis and structural equation modeling were used to test structural relationships among organizational commitment, operations interactions, formal safety indicators, and safety behaviors. Results indicated a good model fit to analyze the nine hypotheses. Two of the nine hypotheses were supported. Safety Values and Safety Personnel significantly influence perceived personal risk. The textual data analysis revealed strong student's opinions towards a medical grounding and no-show procedure initiated by the Flight Department. Additionally, themes identified students' desire to receive more communication of safety information and the language barriers present in a multi-cultural operation.

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Introduction

An Alaska Department of Public Safety (DPS) helicopter encountered a snowstorm and poor visibility while attempting to rescue a stranded snowmobiler in Alaska, ultimately resulting in a crash (National Transportation Safety Board [NTSB], 2014). The NTSB identified an unhealthy safety culture within the DPS as one of the contributing factors to the mishap. According to the Agency, the Alaska DPS had a "punitive safety culture that impeded the free flow of safety-related information and impaired the organization's ability to address underlying safety deficiencies relevant to this accident" (p. viii). The term safety culture first appeared during the investigation of the Chernobyl disaster in 1986. Organizational pressures, program shortcomings, and a flawed safety culture were also causal factors of the Space Shuttle Columbia disaster in 2003 (National Aeronautics and Space Administration [NASA], 2003). Safety culture is a multi-dimensional construct and includes an informed culture, a reporting vulture, a just culture, a flexible culture, and a learning culture (Reason, 1998).

> Safety culture refers to the enduring value, priority, and commitment placed on safety by every individual and every group at every level of the organization. Safety culture reflects the individual, group and organizational attitudes, norms and behaviors related to the safe provision of air navigation services (Civil Air Navigation Services Organization, 2008, p. 1).

Until the early 1970s, accident investigators and researchers focused on weather conditions, technological failures, and especially human errors as root causes of accidents. However, aviation professionals began to recognize that errors and violations are often triggered by organizational factors such as organizational climate, safety culture, safety oversight, safety values and beliefs, and safety programs. Aircraft accidents and incidents are typically the result of multiple contributing factors, with frontline personnel's unsafe acts (e.g., pilots) often influenced by organizational factors and latent conditions (Shappel et al., 2007).

Effective safety management requires much more than just a safety office and safety standards and procedures. According to Ayres Jr. et al. (2009), Safety Management Systems (or any safety program) are most effective in organizations with a strong safety culture. A strong safety culture is difficult to quantify. Nonetheless, in an organization with a healthy safety culture, personnel are proactive and understand that they are responsible and accountable for the safety of their organization. Moreover, employees truly understand the risks associated with their jobs and take action to mitigate those risks. Additionally, they strongly believe that safety should not have to come at the cost of productivity. Most importantly, safety is an integral part of the education and training personnel receive so that they have the knowledge and skills to work safely and effectively (Ayres Jr. et al., 2009).

There is an inherent risk associated with flight training in a collegiate aviation environment (Byrnes et al., 2022). Organizational factors such as the organization's safety climate and safety culture play significant roles in the safety efforts in such a system. Previous studies have suggested that organizations with a healthy safety culture are less prone to experiencing safety-related events. Thus, it is important to better understand the safety culture of students in a Part 141 college flight program. Findings can provide Part 141 flight training schools with data and information to develop or enhance their safety management systems.

Literature Review

Previous studies have attempted to assess the safety culture of flight training organizations. Freiwald et al. (2013) utilized a mixed-method approach to investigate the operations and management staff in a flight training organization, finding a lack of familiarity with the safety reporting system and a deficient accountability system in the organization safety program. As previously noted, professionals with a strong safety culture are responsible and accountable for the safety of their organization. Adjekum (2014) assessed the students' perception on the status of the safety program of an accredited Part 141 four-year collegiate aviation program. Findings suggested that there were significant differences in the perception of the program's safety culture by students based on their national cultures. Power distance, uncertainty avoidance, masculinity vs. femininity, and individualism vs. collectivism are cultural dimensions displayed in a society's rituals and values (Hofstede, 2001). Keller et al. (2015) investigated cultural dimensions between US. Collegiate aviation and Chinese students. A survey questionnaire was distributed electronically to US students and in a paper format to Chinese students at a Chinese university. Findings suggested that relationships between subordinates and superiors (power distance) in China are more unequal than in the US. Similarly, "Chinese aviation students indicated a larger gap between the equality of men and women" (p. 13). The authors concluded that the findings of their study could be used during the development of education policies and other strategies to improve retention, as well as to foster a more effective learning environment. Adjekum et al. (2016) examined the relationship between safety culture perceptions and safety reporting behavior of non-flight students from five Part 141 collegiate flight programs located in the midwestern and southwestern parts of the U.S. Results suggested that inadequate feedback from safety personnel regarding submitted safety reports by non-flight students may reduce the students' interest in reporting safety hazards. Findings also suggested that older and relatively more mature non-flight students may be less willing to report safety hazards. Gao and Rajendran (2017) assessed the safety culture of an Australian collegiate flight program using a self-constructed survey questionnaire. Findings suggested participants had confidence in their organization's safety reporting system but also indicated a perceived distance between students and senior management on the organization's safety culture.

Wheeler et al. (2019) investigated the safety culture of a collegiate flight school in the Southeast of the U.S. Participants were recruited from flight operations and included maintenance personnel and flight students taking core aeronautical courses. The results indicated a positive safety culture across all groups in the flight program. Byrnes et al. (2022) investigated the impact of the COVID-19 pandemic on the safety culture and safety climate of a Part 141 collegiate flight training organization. Researchers utilized longitudinal data from 2018 through 2021. Findings suggested that the safety culture (e.g., effective communications) and safety climate (e.g., personal safety responsibility) constructs were impacted during the COVID-19 pandemic. Silcox et al. (2022) investigated the impact of organizational culture on the safety of a school of aviation science's flight training operations. Participants in this study included members of the flight line services, aircraft maintenance, records, scheduling, dispatch services, flight instruction, and active flight students within Utah Valley University. Researchers identified areas for improvement in the safety culture of the organization, and they included effective communications between key stakeholders and enhanced safety training and education.

Aircraft reliability, as well as aviators' education and training, have significantly improved over the last decades. Nonetheless, aircraft accidents, incidents, and near misses still occur due to organizational and other human factors (Mendonca et al., 2021). Human errors and violations often indicate latent conditions in the aviation system. A robust safety culture will not guarantee there will be no aircraft mishaps resulting from organizational factors. Notwithstanding, it will significantly mitigate the risk of aircraft accidents during flight training. In the past, the pilot pipeline was massively provided by the military in the U.S. The significant shortage of pilots (Department of Defense, 2017) has increased demand for collegiate aviation, which is now the primary pipeline for producing professional pilots. Therefore, there is an imperative need to better understand the safety culture of pilots in a Part 141 collegiate aviation environment. Findings from this study can provide a scientific basis for regulatory decisions, academic policies, and enhanced flight training and education. Most importantly, this study provides an opportunity to close gaps in identified literature and advance safety culture research in aviation.

Methodology

Survey Framework

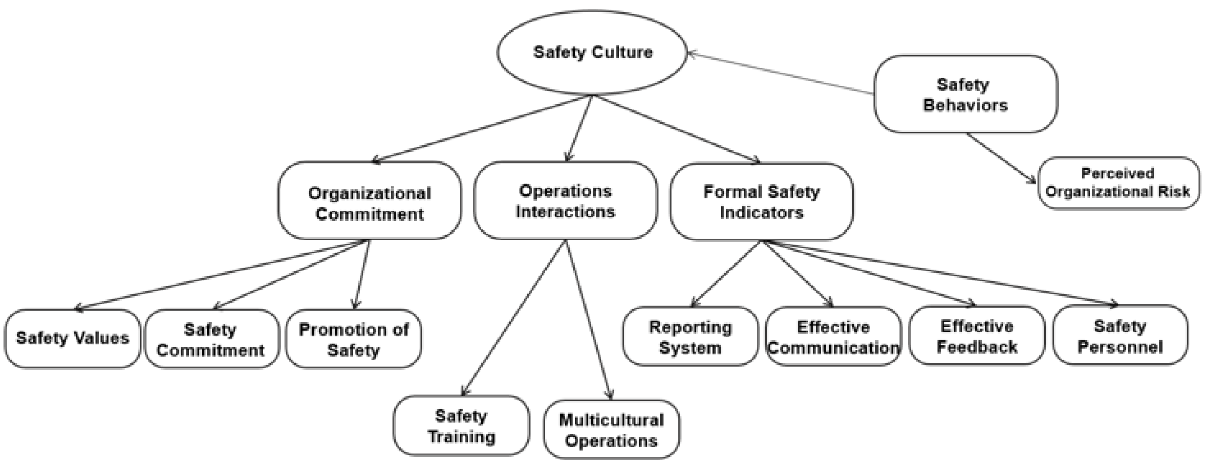
The purpose of the study was to investigate flight students' safety culture at a Title 14 Code of Federal Regulations (CFR) Part 141 flight training school in the Southeast region of the United States. A survey was conducted to determine the relevant factors influencing flight students' perception of the organization's safety culture. The quantitative results of the survey were then analyzed using Structural Equation Model (SEM) techniques. SEM in the form of a relational path model was used to test hypotheses postulated about predictive relationships between the factors and the dimension of safety culture. It was also used to determine the strength of relationships between these factors and the dimension of safety culture. Additionally, researchers generated a Word Cloud from the limited qualitative data, as explained in the results section of this manuscript.

The questions selected for use in the survey were drawn from the Safety Culture Indicator Scale Measurement System (SCISMS), originally based on the Commercial Aviation Safety Survey (CASS). CASS has been implemented by numerous studies in the past decade, demonstrating its utility as a measure of organizational safety culture in aviation operations (Adjekum, 2014; Alsowayigh, 2014; Freiwald et al., 2013; Gibbons et al., 2006; McNeely, 2012; O'Leary, 2016). SCISMS uses a robust four-factor model designed to correlate organizational commitment, formal safety indicators, operations interactions, and informal safety indicators with personal safety attributes (Von Thaden & Gibbons, 2008). The SCISMS produces outcomes on two scales: Perceived Personal Risk/Safety Behavior and Perceived Organizational Risk intended to reflect students' perceptions of safety, thus reflecting the safety climate of the organization. The SCISMS is designed only to capture students' perceptions of risk and does not reflect an objective measurement of safety behavior or risk (Von Thaden & Gibbons, 2008).

Factors affecting students' perceived safety culture were divided into second-order factors, including organizational commitment, operations interactions, and formal safety indicators. Second-order observed variables were then developed. The originally suggested observed variables from the CASS Operations Interactions (supervisors/foremen, operations control/ancillary operations, chief/fleet pilots, dispatch, operations control, ground handling/ramp operations, maintenance/engineering, and cabin crew) were removed from the framework due to their irrelevant application to collegiate flight students directly. These variables were more appropriate for assessing safety culture in instructors rather than flight students. However, Multicultural Operations were added to account for the multicultural climate at this Title 14 CFR Part 141 flight training school in the Southeast United States.

Additionally, some observed variables from the Informal Safety Indicators (accountability, employee authority, and professionalism) were also removed due to their irrelevance to this particular study. Finally, Response and Feedback from the original CASS were divided into effective communication and effective feedback. Figure 1 shows the modified framework used for this study.

Figure 1
Modified Safety Culture Framework



The survey included two open-ended questions allowing respondents to provide suggestions and comments (see below). The open-ended questions were optional and not mandatory to successfully complete the survey.

1. Please describe any additional comments you have regarding safety in the Flight Department.
2. Please describe any recommendations for improving safety in the Flight Department.

Survey Distribution

After Institutional Review Board (IRB) approval was obtained, purposeful sampling was used to target the population of interest. The survey was administered through Microsoft Forms in the English language to allow for simplicity of delivery and anonymity of participants. Participants were assured of the confidentiality of their responses. The survey was open for two weeks.

Hypotheses

The following hypotheses were investigated in the study:

H_1: Safety values significantly influence perceived organizational risk
H_2: Promotion of safety significantly influences perceived organizational risk
H_3: Safety commitment significantly influences perceived organizational risk
H_4: Reporting system significantly influences perceived organizational risk
H_5: Effective communication significantly influences perceived organizational risk
H_6: Effective feedback significantly influences perceived organizational risk
H_7: Safety personnel significantly influences perceived organizational risk
H_8: Safety training significantly influences perceived organizational risk
H_9: Multicultural operations significantly influence perceived organizational risk

Please see Appendix A for information about the questions used in the survey questionnaire to capture each one of these constructs (e.g., safety values).

Population

The population of interest consisted of 1,501 active flight students at a large, accredited Title 14 CFR Part 141 flight training and four-year degree-awarding university in the Southeast regions of the United States (FAA, 2017). The sample (n = 398) was drawn from active flight students accounting for approximately 27% of the population.

Results

Demographics

Demographic information such as gender, age, enrollment status, and international status was collected during the survey. Table 1 shows the demographics of the sample (n=398). Almost 24% of the respondents were international students. Fifty–eight of these students were juniors or seniors. Interestingly, most respondents (80.9%) had not filed a safety report before.

Among all the respondents, 82.2% were men, 17.1% were women, and 0.8% preferred not to say. The gender ratio disbursement of the sample was representative of the population demographics, which has a male-female ratio of 83.3% to 16.7%. Most respondents were domestic students (76.6%). This was also representative of the population with a 77.7% domestic student population.

Table 1
Demographic Variables

Characteristics	Subgroup Categories	Frequency	Percentage
International	International	93	23.4%
	Domestic	305	76.6%
		398	100%
Private Pilot License	Internally earned	169	42.5%
	Earned elsewhere	144	36.2%
	No License received	85	21.4%
		398	100%
Flight Certifications	Student Pilot	91	22.9%
	Private	94	23.6%
	Instrument	104	26.1%
	Commercial-Single	56	14.1%
	Commercial-Multi	16	4.0%
	CFI	16	4.0%
	CFI-I	20	5.0%
	Multi Instructor	1	0.3%
		398	100%
Enrollment	Freshman	93	23.4%
	Sophomore	68	17.1%
	Junior	113	28.4%
	Senior	117	29.4%
	Graduate	7	1.8%
		398	100%
Age	Below 20	128	32.2%
	20-25	249	62.6%
	26-30	16	4.0%
	31-35	2	0.5%
	36-40	2	0.5%
	41-45	0	0%
	46-50	1	0.3%
	Above 50	0	0%
		398	100%
Gender	Male	327	82.2%
	Female	68	17.1%
	Prefer not to say	3	0.8%
		398	100%

Table 1 (*continued)*

Characteristics	Reports Submitted	Frequency	Percentage
Safety Report	0	322	80.9%
	1	52	13.1%
	2	13	3.3%
	3	6	1.5%
	4	4	1.0%
	5	1	0.3%
		398	100%

Analysis of the Responses to the Safety Culture Questionnaire

The current study examined the impact of nine factors – safety values (SV), promotion of safety (PS), safety commitment (SC), reporting system (RS), effective communication (EC), effective feedback (EF), safety personnel (SP), safety training (ST), and multicultural operations (MP) – on perceived organizational risk (SR). In the survey questionnaire, each factor was measured by three- to five-item questions. The respondents were asked to evaluate these items based on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Table 2 shows the values of the mean and standard deviation of the scale items. Figure 2 shows the final specified CFA model, and Figure 3 shows the final specified SEM model.

The sample mean (M) is the average of the observations, and SD indicates the dispersion of individual observations about M. Both the sample mean and standard deviation play important roles, particularly in the context of model fit evaluation and parameter estimation. When the observations are more dispersed, then there will be more variability. In this case, a relatively low SD signifies less variability of data.

Table 2
Mean and Standard Deviation Scores of Constructs

Construct		*M*	*SD*
Safety Values	SV1	4.37	0.816
	SV2	3.54	1.066
	SV3	4.26	0.779
	SV4	4.19	0.865
	SV5	3.90	1.138
Promotion of Safety	PS1	4.09	0.785
	PS2	4.08	0.805
	PS3	4.42	0.723
	PS4	4.40	0.780
	PS5	4.48	0.683
Safety Commitment	SC1	4.21	0.745
	SC2	4.27	0.746
	SC3	3.46	1.176
	SC4	4.15	0.806
Reporting System	RS1	3.71	0.845
	RS2	3.82	0.959
	RS3	4.07	0.766
	RS4	4.07	0.819
Effective Communication	EC1	3.80	0.957
	EC2	3.90	0.884
	EC3	3.97	0.841
	EC4	3.88	0.927
Effective Feedback	EF1	3.79	0.794
	EF2	3.84	0.805
	EF3	3.82	0.817
	EF4	3.39	1.114
Safety Personnel	SP1	4.04	0.810
	SP2	4.07	0.731
	SP3	4.16	0.755
	SP4	4.16	0.724
Safety Training	ST1	4.20	0.801
	ST2	4.10	0.924
	ST3	4.25	0.757
	ST4	4.36	0.698
Multicultural Operations	MO1	3.49	1.153
	MO2	4.00	0.946
	MO3	3.73	1.152
Safety Behaviors	SR1	3.27	1.163
	SR2	2.90	1.197
	SR3	3.51	1.133

Figure 2

The Final Specified CFA Model

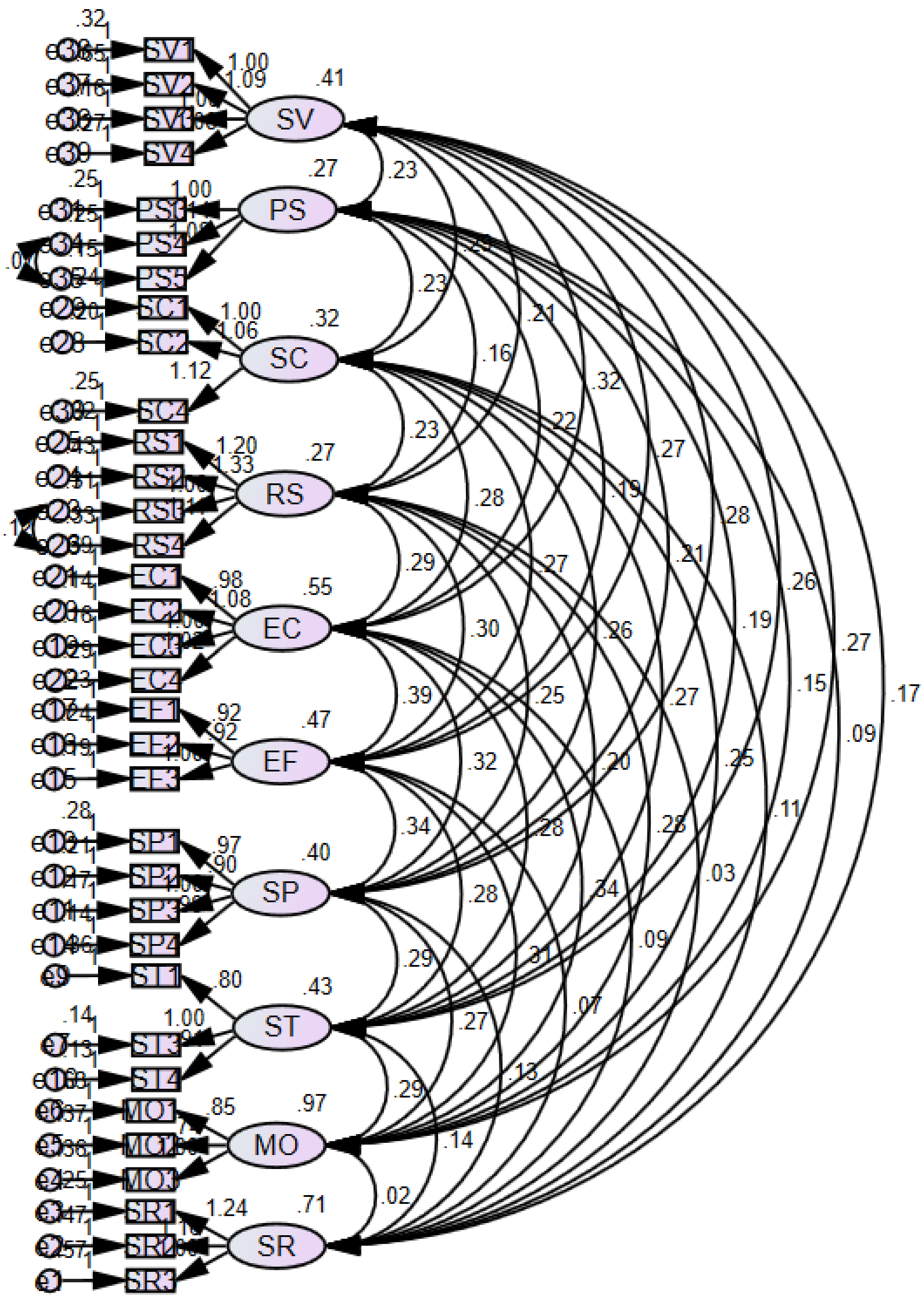
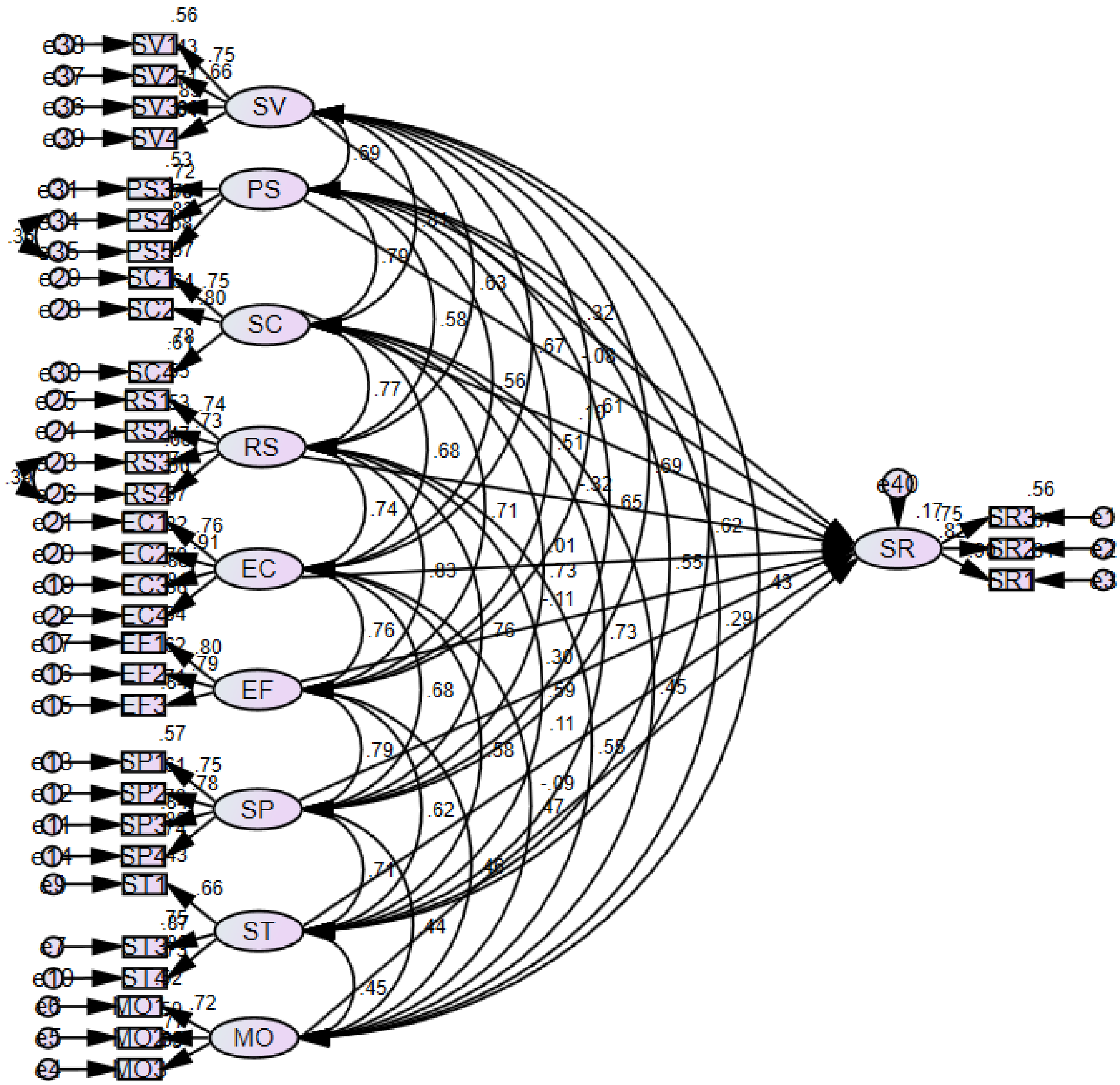


Figure 3
The Final Specified SEM Model



Convergent validity and discriminant validity were examined for the final specified CFA model. PS1, PS2, SC3, EF4, and ST2 items were removed from the initial specified CFA model for reliability and validity. Four indicators of convergent validity were evaluated, including factor loadings, Construct Reliability (CR), Average Variance Extracted (AVE), and Maximum Shared Variance (MSV). The acceptance value for factor loading was ≥ .65, CR was ≥ .70, Cronbach's alpha was ≥ .70, and AVE was ≥ .50 (Hair et al., 2010; Vogt et al., 2012). All the standardized factor loadings passed the .65 threshold, and the CR and Cronbach's alpha were greater than .70, indicating satisfactory consistency among items. AVE values for all factors were greater than .05, indicating satisfactory convergent validity. Table 3 shows the results of the convergent validity assessment for the final CFA model.

Table 3
Convergent Validity Assessment of the Final CFA Model

Construct	Item	Factor Loading	Squared multiple correlations	CR	Cronbach's alpha	AVE
SV	SV1	.75	.56	.78	.83	.59
	SV2	.66	.44			
	SV3	.85	.72			
	SV4	.80	.64			
PS	PS3	.73	.53	.82	.84	.60
	PS4	.76	.58			
	PS5	.83	.69			
SC	SC1	.75	.56	.82	.82	.60
	SC2	.80	.64			
	SC4	.78	.61			
RS	RS1	.74	.55	.81	.82	.51
	RS2	.73	.53			
	RS3	.68	.46			
	RS4	.71	.50			
EC	EC1	.76	.58	.91	.90	.71
	EC2	.91	.83			
	EC3	.88	.77			
	EC4	.81	.66			
EF	EF1	.80	.64	.85	.85	.66
	EF2	.79	.62			
	EF3	.84	.71			
SP	SP1	.75	.56	.88	.88	.65
	SP2	.78	.61			
	SP3	.84	.71			
	SP4	.86	.74			
ST	ST1	.66	.44	.84	.83	.64
	ST3	.87	.76			
	ST4	.86	.74			
MO	MO1	.72	.52	.82	.82	.61
	MO2	.77	.59			
	MO3	.85	.72			
SR	SR1	.90	.81	.87	.86	.68
	SR2	.82	.67			
	SR3	.75	.56			

Note. CR = Construct Reliability, AVE = Average Variance Extracted

Discriminant validity was tested by using the Fornell-Larcker method, which compared the AVE values to the correlation estimates between the constructs, as shown in Table 4. If the square root of AVE is greater than the correlation estimates, the discriminant validity is supported (Zait & Bertea, 2011). Table 4 shows the discriminant validity values. Discriminant validity showed large values for four correlations. However, the correlation between SC and SV, and SC and PS can be explained by the framework in Figure 1. All three variables are the second factors of organizational commitment. Additionally, the correlation between RS and EF, and RS and SP can also be explained by the framework. RS, EF, and SP are the second-factor variables of formal safety indicators.

Table 4
Discriminant Validity Values

	SV	**PS**	**SC**	**RS**	**EC**	**EF**	**SP**	**ST**	**MO**	**SR**
SV	**.768**									
PS	.688	**.775**								
SC	**.808**	**.788**	**.775**							
RS	.634	.583	.769	**.714**						
EC	.674	.564	.684	.739	**.843**					
EF	.607	.515	.712	**.828**	.765	**.812**				
SP	.687	.650	.732	**.761**	.680	.786	**.806**			
ST	.617	.549	.733	.585	.581	.615	.713	**.800**		
MO	.435	.290	.447	.547	.473	.465	.440	.454	**.781**	
SR	.313	.207	.233	.068	.150	.115	.253	.257	.027	**.825**

Structural Model Assessment

The final CFA model in Figure 1 was transformed into a SEM model, as shown in Figure 2. The endogenous variable was perceived personal risk. The data was then assessed for normality and outliers. All kurtosis values were less than 5.00, and squared Mahalanobis values were less than 65. Two error covariances were created between error terms from the largest MI values.

Overall Model Fit

The same acceptance value was used to analyze the model fit. Two pairs of covariances were added between the largest values of error terms. The revised SEM model indicated an acceptable model fit, as shown in Table 5. The Goodness of Fit (GFI) is the proportion of variance accounted for by the estimated population covariance (Hair et al., 2010). The GFI value was slightly off the acceptance value but tolerable (Hu & Bentler, 1999). Hu and Bentler (1999) supported that although a GFI value larger than .90 is recommended, larger than .80 may be used with caution.

Table 5
Model Fit Indices for the Final CFA Model

Model Fit Index	Acceptance Value	Final Model
X^2	-	853.324
df	-	481
Probability	>.05	***
GFI	>.90	.888
NFI	>.90	.906
CFI	>.95	.956
CMIN/df	≤ 3.00	1.774
RMSEA	<.06	.044

Note. *** significant at $p < .001$. GFI = Goodness of Fit Index, NFI = Normed-Fit Index, CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation.

Following the model estimation, hypotheses were tested. Figure 4 illustrates the standardized regression weights for the SEM model. Table 6 shows the standardized path coefficients and *t*-values for the SEM model. Hypotheses with *p*-values less than .05 were supported. H_1 and H_7 had path estimates that were statistically significant in the expected direction, indicating that safety value and safety personnel were significantly correlated with perceived personal risk.

Figure 4
Standardized Regression Weights for the SEM Model

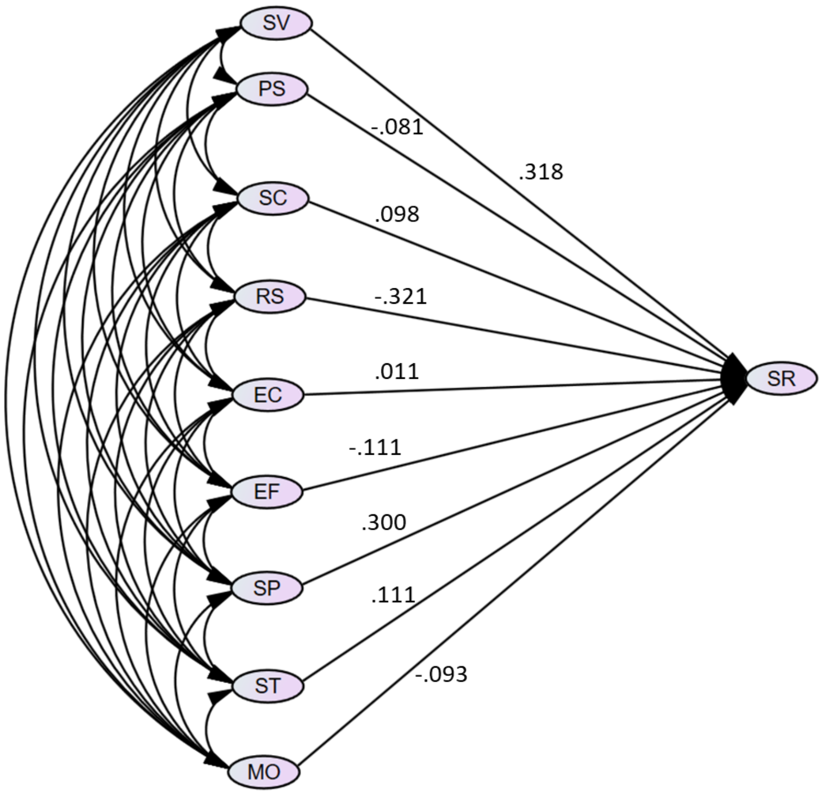


Table 6
Hypothesis Testing Results

Hypotheses	Relationships	SRW	*t*-values	*p*-values	Result
H_1	SV → SR	0.318	2.402	.016	Supported
H_2	PS → SR	-0.081	-0.595	.552	NS
H_3	SC → SR	0.098	0.409	.683	NS
H_4	RS → SR	-0.321	-1.706	.088	NS (Close)
H_5	EC → SR	0.011	0.102	.919	NS
H_6	EF →SR	-0.111	-0.682	.495	NS
H_7	SP → SR	0.300	2.011	.044	Supported
H_8	ST → SR	0.111	0.945	.345	NS
H_9	MO → SR	-0.093	-1.216	.224	NS

Note. SRW = Standardized Regression Weights, NS = Not Supported, SR was reverse-coded so the direction of the SRW and *t*-values should be opposite.

Analysis of the Qualitative Data

As previously noted, the survey included two open-ended questions, allowing respondents to provide invaluable qualitative information. While not all respondents provided an open-ended response, 162 comments were received for textual analysis. The original goal of the researchers was to conduct a sentiment analysis based on the comments and the results of the survey. However, with the limited number of open-ended responses, the study was limited to only a descriptive and qualitative analysis of the textual data. The textual data was then analyzed utilizing various libraries and functions of the Python Programming Language. Firstly, all punctuation from the data was removed to improve processing. Additionally, all the words were reduced to lowercase to maintain consistency and further tokenized into individual features. Stopwords were removed from the textual data to eliminate superfluous words that had a minimal contribution to the textual analysis. Finally, the textual data was lemmatized to improve the comprehensibility of the data. Lemmatization is a process where words are reduced to a root word, such as the word *better* would be reduced to the word *good*. Lemmatization was preferred over stemming due to improved accuracy and domain understanding of the subject.

Once the textual data was processed, a Word Cloud was developed. Based on the initial Word Cloud, the researchers added more stopwords to reduce superfluous words from the generated Word Cloud. Words such as “against”, “other”, “or”, “reason”, listed”, “student”, “safety”, “flight”, “department”, and “feel” were added to the stop words list. Figure 5 was the generated Word Cloud from the textual data. Table 7 displays the frequency and relative frequency of words with a relative frequency of more than 0.5.

Figure 5
Word Cloud from Textual Data

Table 7
Frequency of Words in the Textual Data

Word	Frequency	Relative Frequency
Fatigue	33	1.0
Ground	30	0.909
Sick	19	0.576
No-Show	18	0.545
Training	18	0.545

Note. The word "Ground" refers to the grounding policy for students. Only words with a relative frequency of more than 0.50 and not included in the stop words are included in this table.

Qualitative Analysis for Perceived Risks

A qualitative analysis was conducted to capture relevant and recurring themes in the data. Phenomenological reduction, bracketing, and composite textual and structural description procedures were applied for qualitative analysis. The researchers read the comments and manually coded sentiments to identify themes. Three significant themes regarding perceived safety risks were captured from the data.

Medical Grounding and No-Show Policy

The Medical Grounding and No Show Policy was the most recurring theme in the textual data. Respondents had a negative sentiment regarding a recently implemented policy. The "No

Show Policy" changes were reviewed using the SMS risk assessment process, and no increase in risk severity and probability was found. Nonetheless, we recommend further studies on the impact of this "No Show Policy" on flight students' perceptions of safety culture.

Information Sharing and Communication

Information sharing and communication was theme evaluated in 13 comments. The findings supported that some students feel that communication regarding safety incidents and accidents could be improved. Effective safety communication is vital for a sound safety culture. "The free exchange of safety information, across all areas and through all levels, both vertically and horizontally, is actively promoted by management and facilitated by mechanisms and processes" (Ayres Jr. et al., 2009, p. 156).

Multi-cultural Operations.

Multi-cultural operations was a theme evaluated in four comments. The findings supported that some students feel that a language barrier due to a multi-cultural environment could affect their perceptions of safety as suggested by the International Civil Aviation Organization (ICAO, 2002). Part 141 flight training organizations are increasingly and steadily becoming multicultural. Individuals from different nations may be paired in the cockpit, and language barriers may disrupt effective communication.

Thematic Analysis

The qualitative data analytics procedures described in this paper were intended to gather better insight into the sentiments of the respondents regarding the organization's safety culture. The qualitative analysis utilized a phenomenological framework that allowed the respondents to share their lived experiences in the specified area of study. A significant theme identified from the responses focused on policy making in the organization, specifically related to a "no show" policy. These results supported previous research in the literature review and the SEM model that highlighted the role of policy-making in an organization having a significant impact on safety awareness and culture. Additionally, the theme of information sharing in improving safety culture supported the need for management to share data, trends, and policy changes with employees to improve trust and accountability. The results of the qualitative data were coherent with the SEM analysis and previous literature on the subject; however, it adds to the literature on incorporating a robust safety culture in a flight training environment through an increased focus on policy-making and better-informed communication from management.

Discussions and Conclusions

The overall purpose of this study was to investigate flight students' perceived safety culture at a Title 14 Code of Federal Regulations (CFR) Part 141 flight training school in the Southeast region of the United States. The results suggested a direct and strong predictive relationship between safety culture in collegiate flight training and the perceptions of respondents of the safety value and safety personnel multidimensional constructs of safety culture. Based on the operational definition of the constructs, Safety Personnel and Safety Values were directly related to the policy, objectives, and actions of the management of the Flight Department. An effective indicator of a strong safety culture is top-management overall safety vision, values, and commitment to safety (von Thaden & Gibbons, 2008). A Part 141 flight training organization's safety culture can be strengthened by making visible the commitment of senior leadership management and by actively involving personnel in the management of safety risks. "When management actively endorses safety as a priority, it is typically well-received by personnel and becomes part of normal operations" (ICAO, 2018, p. 1-2). According to Reason (1998), a safety report allows aviation professionals to let safety professionals investigate each single hazard, and it is considered a necessary step in the organization's accident prevention efforts. Most importantly, a reporting culture is an intrinsic element of a safety culture. While 81% (n=322) of students had never submitted a safety report, and only 3% (n=11) had submitted three or more safety reports, this could be attributed to the fact that 97% of flights are conducted with a flight instructor on board. Typically, the flight instructors will fill out the safety reports, the great majority of times, alongside their students. It is plausible to assume that most student-initiated safety reports are from their solo flight activities.

The textual data was used to analyze the impact of Safety Values and Safety Personnel on students' perceptions. Findings indicated that students have positive sentiments regarding the organizational safety values of the Flight Department. While the qualitative analysis highlighted some negative sentiments regarding specific policies, especially the No-Show policy, the overall safety culture and awareness for students are positively influenced by the safety values instilled by management and safety personnel. Respondents' feedback can be utilized to modify policies and to improve the safety culture and communication.

Researchers acknowledged that there are limitations to this study. For example, the narrow band of age and flight experience, as well as the sample size, will not make the results generic to other aviation professionals outside that domain. Psychosocial and other human factors such as stress, family issues, workload, and organizational pressures may have biased the opinions of respondents. Only 24% of the respondents were international students. Additionally, only 10% of them were CFIs. The research team attempted to collect data from collegiate aviation pilots with different flight experiences, enrollment levels, nationalities, and flight certificates in order to have a better picture of how these students perceived their organization's safety culture. As suggested by Adjekum et al. (2016), previous safety events experienced by participants and or their colleagues could have influenced their perceptions of the safety culture elements. In addition, students within the organization are being instilled with safety culture concepts during ground and flight training and education, as suggested by Ayres et al. (2009). Students are being mentored and influenced by the organizational safety culture, the safety values of the organization, and their instructors are being espoused on them through mentorship. Through the affective domain, this mentorship is molding their values and beliefs in safety. As a result, their perceptions of the organizational safety culture may be incomplete/premature as they are in the process of learning the culture through mentorship and immersion. The stated limitations could potentially bias some of the findings in this study and affect generalizability across the entire aviation workspace.

Recommendations

Recommendations for future research should focus on increasing the sample size of student participants taking the Safety Culture survey and revising factors and constructs based on continuous feedback and changes. Increasing the sample size would improve the validity of the model and help utilize textual data for correlational analysis utilizing principles of Natural Language Processing. Future research should also consider implementing a similar survey for other staff members of the Flight Department, such as the maintenance technicians and dispatch. Implementing the survey for different staff members will ensure a more comprehensive sampling strategy and assist in identifying significant factors and constructs for Safety Culture and Awareness. Identifying significant factors will assist in designing Safety Management System (SMS) training for staff and students. Gathering quantitative and qualitative inputs from students on perceived risks and factors would allow for the continuous review of model factors and qualitatively validate findings. Finally, future research should utilize existing safety data infrastructure to identify factors and trends to improve model development and factor analysis for further studies. More importantly, our findings could provide the scientific foundation for academic policies, flight training, and educational safety efforts to strengthen the safety culture of pilots in a Part 141 collegiate aviation environment. After all, "safety culture does not just happen by chance. It is the product of deliberate efforts by senior management without which any good safety record will be transient" (ICAO, 2002, p. 3-8).

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Appendix A

Safety Values

Safety Values refer to the "attitudes and values expressed in words and actions by leadership regarding safety" (Von Thaden & Gibbons, 2008. p.11). In other words, it refers to the values the Flight Department's leadership places on safety. Leadership refers to the Flight Department Chair, Chief Flight Instructor, Assistant Chief Pilot Instructors, and the Training Managers. Safety performance should be consistently monitored and evaluated with the same attention to exceeding goals or finances. To capture this, the following questions were used:

SV1. The leadership in my Flight Department considers safety as a core value
SV2. The leadership in my Flight Department is more concerned about being safe than making money
SV3. The leadership in my Flight Department shows concern for safety before an accident or incident happens
SV4. The leadership in my Flight Department does not cut corners when safety is concerned
SV5. The leadership in my Flight Department does not expect pilots to complete flight training activities if it means compromising safety

Promotion of Safety

Promotion of safety refers to "compliance with regulated aspects of safety such as training requirements, manuals and procedures, equipment maintenance, and the coordination of activity within and between teams/units" (Von Thaden & Gibbons, 2008, p. 11). At this level, the Flight Department should encourage safe business practices and provide a solid framework for the organization, managers, and flight instructors to meet predetermined safety requirements. Therefore, the following questions were used:
PS1. My Flight Department's checklists and procedures are easy to understand
PS2. My Flight Department is willing to invest resources to improve safety
PS3. My Flight Department is committed to equipping aircraft with up-to-date technology
PS4. My Flight Department ensures that maintenance on aircraft is adequately performed
PS5. My Flight Department ensures that aircraft are safe to operate

Safety Commitment

Within the original SCISMS framework, Safety Commitment was formerly labeled as Going Beyond Compliance. This factor was renamed to Safety Commitment to more accurately capture flight students' perceptions of their flight instructor's commitment to safety. Safety Commitment refers to the "priority given to safety in the allocation of company resources (e.g., equipment, personnel time) even though they are not required by regulations" (Von Thaden & Gibbons, 2008, p. 11). This may be reflected in rostering, scheduling shiftwork and rest time, fatigue management programs, and risk management programs. The following questions were used:

SC1. The leadership in my Flight Department views violations (e.g., airspace violations, flight operations manual non-compliance) very seriously, even when they do not result in any serious damage or injury
SC2. The leadership in my Flight Department seeks more than regulatory minimums when it comes to issues of flight safety
SC3. The leadership in my Flight Department ensures that my Flight Instructors are not fatigued during activities
SC4. The leadership in my Flight Department does not try to get around safety requirements

Reporting System

In addition to a safety-related event data collection system, CFR Part 141 flight departments must have a non-punitive reporting system to encourage safety reporting. To assess the utility of the Aviation Safety Reporting System within the Flight Department, the following questions focused on capturing perceptions surrounding accessibility, familiarity, and actual use of the organization's safety reporting system.

RS1. The safety reporting system is convenient
RS2. I can report safety discrepancies without fear of negative repercussions
RS3. I am willing to report information regarding the unsafe actions of other pilots
RS4. I am willing to file reports about unsafe situations, even if the situation was caused by my own actions

Effective Communication and Effective Feedback

The original SCISMS framework labels this factor as Response and Feedback, referring to the "timeliness and appropriateness of management responses to reported safety information and dissemination of safety information to workers" (Von Thaden & Gibbons, 2008, p. 13). However, the current study broke this down even further into Effective Communication and Effective Feedback. According to Reason (1998), the effective communications of an organization's safety values and beliefs are critical, and a strong safety culture is present when each individual is clear on what behavior the organization considers acceptable or unacceptable. The questions for effective communication were adapted from a survey by Grabowski et al. (2009).

EC1. Safety issues raised by pilots are communicated regularly to all other pilots
EC2. There is good communication in the Flight Department about safety issues
EC3. The Flight Department is very effective in communicating safety information
EC4. I am kept informed about the Flight Department's safety information
EF1. When a pilot reports a safety problem, it is corrected in a timely manner
EF2. The Flight Department keeps the feedback regarding safety concerns confidential
EF3. I am satisfied with the way the Flight Department deals with the safety reports
EF4. I am given feedback on accidents, incidents, near misses, or injuries that occur in the Flight Department

Safety Personnel

Safety personnel refers to the "perceived effectiveness of and respect for people in formal safety roles" (Von Thaden & Gibbons, 2008, p. 13). Within a CFR Part 141, the safety personnel within the Flight Department refers to the Director of Aviation Safety and the Aviation Safety Program Manager. To capture the perceived commitment of formal safety personnel, the following questions were used:
SP1. Personnel responsible for safety hold high status in the university
SP2. Personnel responsible for safety have the power to make changes
SP3. Personnel responsible for safety have a clear understanding of the risks involved in flight
SP4. Safety personnel demonstrate a consistent commitment to safety

Safety Training

Safety Training is the "extent to which those who provide safety training are in touch with the actual risks and issues associated with performing a particular activity and the extent to which training is offered and is deemed effective" (Von Thaden & Gibbons, 2008, p. 12). These questions were chosen to provide insight into how effectively safety training is integrated throughout the Flight Department.

ST1. The flight instructors prepare me for various safety situations, even uncommon or unlikely ones
ST2. The flight instructors do not teach ways to get around safety requirements
ST3. The flight instructors consistently emphasize safety during training
ST4. The flight instructors have a clear understanding of the risks associated with flight operations

Multicultural Operations

With a large number of international students and flight instructors, it is important to consider how multicultural operations impact safety culture and communication. Wang (2008) and Byrnes (2015) suggested that multicultural operations could be an essential factor influencing safety performance, especially in regard to multi-cultural backgrounds and language barriers. Therefore, 'Multicultural operations' was also added to the framework and the following questions were used:

MO1. Language differences in multi-cultural flight instructors are not a threat to safety
MO2. I enjoy working with multicultural flight instructors
MO3. There are no differences in the performance of flight instructors from different cultures

Informal Safety Indicators

Informal safety indicators included three factors - accountability, employee authority, and professionalism; however, informal safety indicators were deleted from the modified framework as they reflect employees' perception of safety culture rather than those of the students.

Operations Interactions

Operations interactions refers to "the degree to which those directly involved in supporting work or the supervision of [students] are actually committed to safety and reinforce the safety values espoused by upper management when these values are positive" (Von Thaden & Gibbons, 2008, p. 12). Operations interactions are reflected in relationships with supervisors, flight instructors, and other operations personnel with consideration for safety. To glean insight into the safety climate of those working directly with flight students, questions were asked to assess the extent to which flight instructors promote safe operations, as well as weigh the influence Multicultural Operations may have on students' perceptions of safe operations.

Safety Behavior/Outcomes

Safety behavior or safety outcomes are reflected in the outcome variable, perceived organizational risk. The questions selected provide meaningful insight into students' perceptions regarding the likelihood of a negative safety event occurring. The safety culture of a flight school is expected to predict safety behaviors based on students' perceptions of risk (Cooper & Phillips, 2004). Thus, gleaning insight into the level of trust and confidence students have in their organization's safety culture could potentially aid in early risk mitigation strategies.

Perceived Organizational Risk

Serving as an outcome variable, the Perceived Organizational Risk scale addresses a student's beliefs about the likelihood of negative safety occurrences at the Flight Department. This constitutes a global evaluation of the students' assessments of the Flight Department's overall safety level. This measure also provides insight into what students perceive as being out of their control and the responsibility of the flight department itself.

SR1. Someone in the Flight Department is likely to be involved in an accident over the next twelve months
SR2. Someone in the Flight Department is likely to be involved in an incident over the next twelve months
SR3. Someone in the Flight Department is likely to be cited by the FAA for a major safety violation over the next twelve months