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Analysis of the Differences in Perceptions of Safety Reporting Systems between Collegiate Aviation Students and Airline Pilots

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Collegiate education and training prepare students to enter the workforce, and the collegiate experience should reflect practices in use within an industry. Collegiate aviation combines academic and practical experience with the integration of an industry-standard safety emphasis from the beginning of training. One facet of this safety emphasis, safety reporting, is an integral part of safety management systems (SMS) used in professional aviation. This study examined the differences in the perceptions of safety reporting systems between the pilots of a U.S. major air carrier and the collegiate students enrolled in the aviation program at a U.S. university. A cross-sectional survey was used to collect data from these two groups. Statistical analysis found that collegiate aviation students and airline pilots witnessed a similar number of safety-related issues during the study period. Airline pilots submitted safety reports with greater frequency than did students. Collegiate aviation students in this study indicated that report confidentiality concerns were a factor in this lower reporting rate. The study also found that the perceived effectiveness of organizational safety policies and procedures is influenced by, and inversely proportional to, the number of safety-related issues witnessed by study participants.

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Collegiate education and training prepare students to enter the workforce, and collegiate training for the aviation industry requires a balance of both knowledge and practical experience. Too much knowledge coupled with too little experience renders a student deficient in basic practical skills foundational to success in the industry. Conversely, too little knowledge and a disproportionate level of practical experience may insufficiently prepare a student for the academic rigors of professional aviation and its increasingly complex systems (Carney, 2014). To produce a well-equipped student ready for a career in the aviation industry, collegiate aviation training strives to mirror real-world applications and procedures. However, the ability to fully replicate the industry requires resources beyond the scope of most collegiate aviation programs. Earning any one of numerous aviation certifications constitutes a "license to learn" in industry vernacular, thus making collegiate aviation an environment that provides students the foundational knowledge and practical skills on which to build as they enter the industry (Carney, 2014).

While imparting knowledge and skills is a central part of collegiate aviation education, safety and safety awareness must be imbued in every aspect of the student's educational experience beginning with his/her first course. Safety practice and safety awareness permeate every facet of professional aviation, and a student will not be prepared to enter the industry if they cannot perform progressively complex tasks safely. The collegiate aviation students of today will be the aviation professionals of tomorrow, responsible for ensuring the safety of the flying public. In this study, we surveyed collegiate aviation students from a single U.S. collegiate aviation program and airline pilots from a U.S. FAR 121 major carrier to examine the perceptions of safety reporting systems of both groups and determine if differences exist.

Safety training should be presented and reinforced through practical application in an aviation context to adequately prepare the collegiate aviation graduate to enter the professional aviation workforce. This includes the use of safety reporting systems in place in a student's collegiate aviation program. Reporting safety issues, concerns, or operational safety-related events provides an input to an organization's Safety Management System (SMS) safety assurance function. The data provided by these reports allows the investigation, monitoring, data analysis, system assessment, and corrective action that give an SMS value as a proactive safety tool (FAA, 2020b). These steps within safety assurance allow an SMS and a collegiate aviation program specifically to evaluate its safety climate, identify safety-related trends in its operation, and proactively establish or modify policy and procedure to mitigate risk. Safety reporting by operational users is an essential input to this process as they provide direct observations of the system and how it is used (Lyle, 2020).

Problem Statement

The purpose of this research is to determine the differences, if any, in perception between airline pilots and collegiate aviation students regarding aviation safety reporting systems. The

results of this research will contribute to a better understanding of any differences between industry practice and the collegiate aviation environment and provide input for their further alignment.

Research Question

RQ1: Is there a difference between airline pilots and collegiate aviation students regarding their perceptions of aviation safety reporting systems?

Hypotheses

$H1_o$: There is no difference between airline pilots and collegiate aviation students regarding their perceptions of aviation safety reporting systems.

$H1_a$: There are differences between airline pilots and collegiate aviation students regarding their perceptions of aviation safety reporting systems, and these differences influence the reporting habits of the two groups.

Literature Review

The concept of safety has become as labyrinthine as the governmental entities that conceived it and is somewhat contextual and unable to be defined in simplistic terms. From the perspective of the flying public, safety is defined as traveling from point A to point B without injury or death (Stolzer et al., 2013), but for the safety practitioner, that definition is too minimalist. The Federal Aviation Administration (FAA) definition of safety is "…the state in which the risk of harm to persons or property damage is acceptable" (FAA, 2020b, p. A-1). In the current aviation context, safety is often synonymous with SMS, which the FAA describes as "…the formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systemic procedures, practices, and policies for the management of safety risk" (FAA, 2020b, p. A-2). An SMS is comprised of "…a safety policy, safety risk management, safety assurance, and safety promotion" (FAA, 2020b, p. 8).

Prior to the advent of SMS, safety was a collection of uncoordinated initiatives implemented to prevent catastrophe (Pollock, 1995). As safety education and training have evolved to a more structured, standardized, and integrated format, this has added a new dimension to the collegiate aviation experience. Given this improved safety paradigm, collegiate aviation students must be trained holistically by learning and implementing safety practices within an intentional safety culture. In the collegiate aviation setting, one way to prepare students for the safety challenges they may encounter in the industry is to expose students to SMS early in their training (Velazquez & Beier, 2015). In addition, a student should gain familiarity with SMS when immersed in an environment where a robust SMS is in use. Not only do students learn about SMS, but a higher-risk collegiate flight training setting will also benefit. Safety challenges in a flight training environment are unique; high volumes of inexperienced students are often trained by flight instructors who are their only slightly more experienced peers (Adjekum, 2013). In the flight training environment, students and instructors are subject to simulated malfunctions, maneuvers, and non-normal situations not commonly encountered in

professional flying (Adjekum, 2014). For example, professional pilots usually only practice non-normal maneuvers in a flight simulator under controlled conditions and only in the aircraft in an actual emergency or as prescribed as a specific check as part of a post-maintenance check flight.

The value contained in an aviation safety report is the first-hand account of an event by the individual who experienced it, and the documentation of relevant factors contributing to the event (Cohen & Crabtree, 2006). An aviation safety report follows the narrative analytical structure of Rogan and de Kock (2005) by "…asking directly for information…" and "…solicitation of specific narrator experiences…" (p. 632), examined for additional contextual information, and "…evidence for interpretation in the (report) was also sought by examining…the narrator's connecting logic of the sequence of events" (p. 641-642). Aviation safety reporting is an essential input to an organization's SMS safety assurance process, providing data for trend analysis and a proactive safety approach (FAA, 2020b).

An airline safety reporting system known as ASAP (Aviation Safety Action Program) is built on the general concept of candid safety reporting in exchange for no certificate action against the reporting entity (FAA, 2020a). The signatory parties to a Memorandum of Understanding (MOU) which establish and continue an ASAP program are the airline company, the FAA, and an employee representative such as a pilot union. There are strict rules established by FAA orders and regulations that govern the handling of an ASAP report, how they are de-identified, and how the data may be used (FAA, 2003, 2020a). When an ASAP report has completed the review process at the airline level, the de-identified data are submitted to the NASA Aviation Safety Reporting System (ASRS) to be included in the aggregate ASRS public database.

As part of its accreditation process for collegiate aviation programs, the Aviation Accreditation Board International (AABI) works with industry partners to define the "competencies and attributes desired of graduates" of collegiate aviation programs (Carney, 2014). AABI uses these industry inputs in the accreditation process to ensure that aviation program graduates have "an ability to use techniques, skills, and modern technology necessary for professional practice" (Carney, 2014). The collegiate aviation program included in this study is an AABI accredited institution. As the sole recognized accreditor for aviation programs worldwide, AABI recognizes the need for synergy between collegiate aviation and the aviation industry (Carney, 2014). If AABI seeks to prepare collegiate aviation students for "professional practice", aviation safety reporting is part of that preparation.

The collegiate aviation student group surveyed for this study was made up of both professional pilot students and aviation maintenance students. These were the two largest concentrations of students in the aviation department of the study university (University Aviation Association [UAA], 2016), and are also the two student groups most likely to be covered by a formal aviation safety reporting system in professional practice (FAA, 2020a). The student group at the study university is also somewhat unique in that the subject university offers both areas of study, not the case at all collegiate aviation programs (UAA, 2016). Flight education and aviation maintenance are also specifically listed as concentrations subject to the AABI accrediting process, a process designed with industry inputs to prepare students for careers in professional aviation. (Carney, 2014).

Methods

The data collection instrument used in this study was developed from the Collegiate Aviation Perception of Safety Culture Assessment Survey (CAPSCAS), and the survey questions were tailored to fit the sampling requirements of the airline pilot group. As a survey instrument, questions in the CAPSCAS were modified from the Commercial Aviation Safety Survey (CASS) developed by researchers at the University of Illinois Champagne-Urbana (Adjekum, 2013). The CASS is a validated survey instrument that "…identifies the respondents' perception of the current state, as well as the strengths and weaknesses, of the safety culture in an organization" (Adjekum, 2013, p. 18). In addition, supplementary survey questions were also adapted from another unrelated pilot-tested survey instrument (Siao, 2015). The survey instrument used for data collection for this study is included in Appendix A.

Four sub-areas were identified for the study: demographics, safety value, safety reporting, and overall level of safety. When tailoring the survey instrument for the airline pilot group, every effort was made to keep the phrasing of survey questions as identical as possible to the survey questions presented to the collegiate aviation student group. This was done to standardize the survey instrument across both groups and minimize potential bias in survey responses. The researchers felt that the homogenization of the questions between the two groups was important in this case to accurately measure any differences or similarities between groups regarding perceptions of aviation safety reporting systems.

Airline Pilot Group and Sampling Procedures

The airline pilot group sampled was comprised of active pilots listed on the Master Seniority List of a U.S. major commercial air carrier as of March 1, 2016. Approval to survey the pilot group was obtained from the pilot's union Safety Committee Chairman and union Executive Officers. A link to the survey was disseminated to pilots via a weekly union communication vehicle that was sent to all pilots electing to receive it. Due to the proprietary nature of this information, it is not specifically known how many of the 8000 airline pilots elected not to receive this union communication vehicle.

Sampling of the airline pilot group was done electronically through a survey link hosted on www.surveymonkey.com. Other than the modification of demographic questions unique to the airline pilot population, substitution of the word "airline" for "university" in questions 9 and 15, and "airline" for "department" in question 20, the questions were identical to the questions administered to the collegiate aviation student population. Participation was completely voluntary, with participant consent obtained by proceeding past the first page of the survey to begin the demographic section. Anonymity was guaranteed to participants through filters placed on the survey by the researchers that prevented the collection of any personally identifiable information – e.g., the "track IP" function was disabled to provide an additional layer of anonymity.

Collegiate Aviation Student Group and Sampling Procedures

The collegiate aviation student group sampled consisted of university students enrolled in the professional pilot and aviation maintenance programs of a single U.S. university. While the selection of a single collegiate aviation program does limit the ability to generalize findings to collegiate aviation in general, it does provide a consistent baseline of procedures, policies, and safety reporting systems for comparison and analysis. The collegiate aviation program chosen for this study offers six undergraduate concentrations within the Department of Aerospace: administration, technology, dispatch, maintenance, professional pilot, and unmanned aerial systems (UAS). For this study, the researchers chose students from the maintenance and professional pilot concentrations, which represent the two largest concentrations in terms of enrollment, 100 and 348, respectively. (University Aviation Association, 2016).

Participants in the collegiate aviation group were intentionally recruited to ensure a balanced representation between the maintenance and professional pilot concentrations. Students were surveyed in various classes and informed of the voluntary nature of survey participation. Students indicated their consent to participate by signing an informed consent document which was collected separately from the survey itself to ensure anonymity. There were no positive incentives or negative consequences offered for survey participation.

Research Design

The data collection instrument for the airline pilot group was a 21-question survey utilizing a five-response Likert scale for most responses. Of the 21 questions that made up the survey, five were related to demographics, two related to safety value, ten related to safety reporting, and four related to the perception of the overall level of organizational safety (see Appendix A). The survey was open for responses on www.surveymonkey.com from March 26, 2016, to April 19, 2016, with the survey link published in two union communications during that period. Similarly, collegiate aviation students at the subject university were surveyed beginning March 26, 2016, with the last survey administered on April 20, 2016. The design of the airline pilot survey was such that once a respondent began participating in the survey, responses to the questions could be changed while that session was open. Once the respondent exited the survey, there was no ability to change response or participate in the survey more than once. Printed surveys were distributed to the collegiate aviation students in class, and students declining to participate were given the option to turn in a blank survey along with the rest of the class. There was no requirement for a student to complete the survey.

Demographic data were collected during the survey for two primary purposes. The first was to identify the modal groups in each sample. The second was to identify the presence in the student group of respondents outside the modal group that may indicate a non-traditional student that has had previous exposure to a formal safety reporting system such as those used in the military. This would also be the case with airline pilots responding to prior employment with another major airline or the military where a formal safety reporting system was in use.

The survey instrument contained 21 questions and indicated the use of exploratory factor analysis using varimax rotation. A scree plot was used to retain factors with the condition that

Eigenvalues must be above 1. An initial examination of the correlation matrix revealed no correlations above 0.9, indicating no multicollinearity in the data. The determinant was 0.099, which is greater than 0.00001 (Field, 2014). The Kaiser-Meyer-Olin value was .702, well above the minimum criterion of 0.5, suggesting that the sample size was adequate for factor analysis (Field, 2014). Bartlett's test was significant (p = .000), which showed that this was not an identity matrix. As mentioned earlier in this paragraph, only factors with Eigenvalues greater than 1 were extracted which included two factors in this case: safety as a core value and safety report submission rate.

Reliability analyses were conducted on both factors. The initial Cronbach alpha for factor 1 was a = .717, with a value of .70 and above indicating high internal consistency (Adjekum et al., 2015; Field, 2014). While this was satisfactory, deletion of question 6 would increase the Cronbach alpha to a = .738; however, reliability of a = .717 and a = .738 were close, and question 6 was not deleted. For factor 2, the initial Cronbach alpha was a = .680, below the threshold of a = .70 for social science research. The inter-item correlation matrix revealed a low correlation for question 21. Deleting question 21 would increase the Cronbach alpha for factor 2 to a = .717. To increase reliability, question 21 was deleted, the reliability analysis was re-run, and yielded an improved Cronbach alpha value of a = .717 as expected.

The airline pilot survey produced 128 responses during the survey period (n = 128) for a response rate of 1.6% of the pilots at the study airline. The collegiate aviation student survey produced 59 responses (n = 59) for a response rate of 13.2%, for a total of 187 responses (N = 187). Permission to conduct this study was approved by the Institutional Review Board at Middle Tennessee State University (IRB Protocol ID: 16-1226).

Results

Demographic Analysis

Professional pilot sample.

Pilot participants from the U.S. major airline (n = 128) were asked to indicate their current seat position: First Officer, Captain, or Check Airman. No participant selected Check Airman. Participants were also asked to specify their age group from five broad categories: 20-30, 31-40, 41-50, 51-60, and 60-65. It should be noted here that the minimum age to obtain an Airline Transport Pilot certificate required for hire at a U.S. major airline is 23 (21 in certain circumstances), and mandatory retirement as set by the FAA is age 65. From these age groups, 41-50 and 51-60 were the modal groups comprising 75.8% of the professional pilot sample, with the mean of 3.5 lying evenly between these age categories. The background of the airline pilot group, as indicated by previous employment, is varied, with Military (38.3%) being the modal group followed by Other Major Airline (27.3%; Table 1). There was one female respondent in the professional pilot group.

Table 1
Professional pilot demographic variables of Seat Position, Age, and Prior Employment

Variable	Value	Percentages	Variable	Value	Percentages
Seat Position			Prior Employment		
First Officer	51	39.8%	Corporate	17	13.3%
Captain	77	60.2%	Military	49	38.3%
Check Airman	0	0%	Freight	6	4.7%
			Regional	21	16.4%
Age Group			Other Major Airline	35	27.3%
20-30	1	0.8%			
31-40	11	8.6%			
41-50	52	40.6%			
51-60	45	35.2%			
61-65	19	14.8%			

Collegiate aviation student sample.

Similar to the question of seat position for airline pilots that is driven by seniority, students were asked to select their year group: Freshman, Sophomore, Junior, Senior, and Other. The Other category was included to accommodate graduate students but was not selected by any student respondent. The age groups were modified for the collegiate survey using smaller category ranges at five-year intervals. The modal group is the 20-25 age range, which comprises 78% of the collegiate respondents (Table 2). Students in age categories above the modal group were 13.6% of the collegiate aviation student group. In place of prior employment in the airline survey, students indicated their international or domestic status. Female student participation was low as was the case with airline pilots, with only four female respondents in the collegiate group.

Table 2
Collegiate demographic variables of International Status, Age, Year Group, and Concentration

Variable	Value	Percentages	Variable	Value	Percentages
International/Domestic			Age Group		
International	12	20.3%	Below 20	5	8.5%
Domestic	47	79.7%	20-25	46	78.0%
			26-30	5	8.5%
Year Group			31-35	2	3.4%
Freshman	3	5.1%	36-40	0	0%
Sophomore	23	39.0%	41-45	0	0%
Junior	19	32.2%	46-50	0	0%
Senior	14	23.7%	Above 50	1	1.7%
Other	0	0%			
			Concentration		
			Pro-Pilot	24	40.7%
			Maintenance	31	52.5%
			Other (see note)	4	6.8%

Note. The "Other" category under concentration includes Administration and Flight Dispatch.

Safety as a Core Value

There was no significant difference between collegiate aviation students and airline pilots on how they perceived safety as a core value of their department or workgroup. Aviation students (M = 4.27, SE = .14) viewed safety as a slightly higher priority within their department than did airline pilots (M = 4.19, SE = .11), possibly representing a negligible difference. The difference, -0.08, BCa 95% CI [-.262, .427], is not significant t(184) = .448, p = .654, and represents a small effect, r = .07.

There was no significant difference between collegiate aviation students and airline pilots in how they viewed the concern for safety demonstrated by the leadership of their department or workgroup. Aviation students (M = 4.17, SE = .11) said that their leadership showed a slightly higher concern for safety than did airline pilots (M = 4.07, SE = .09), a small difference. The difference, -0.10, BCa 95% CI [-.215, .395], is not significant t(184) = .639, p = .524, and represents a small effect, r = .05.

Awareness of a Safety Reporting System

Regarding a difference between airline pilots and collegiate aviation students in their awareness of aviation safety reporting systems, this study found no significant difference between the two groups. When asked whether participants were aware of a safety reporting system in their department/workgroup, all collegiate aviation students (n = 59; 100%) responded "Yes", 125 airline pilots (n = 128, 98%) responded "Yes", with two responding "No" (1.6%). Although there was a small difference between the two groups, the difference was not significant t(184) = -.966, p = .335, and represented a small effect, r = .07. There were some significant differences found in the sub-areas of safety value, safety reporting, and overall level of safety between the two groups that are reported in the following paragraphs.

Safety Reporting

The data indicated a significant difference between collegiate aviation students and airline pilots when asked if they had submitted an aviation safety report. 93.2% of collegiate aviation students surveyed (M = 1.93, SE = .03) responded that they had not submitted a report, while 84.3% of airline pilots surveyed (M = 1.16, SE =.03) indicated that they had (Table 3). The difference, 0.77, BCa 95% CI [.661, .871], is significant t(156.84) = 16.737, p = .001, and represents a large effect, r = .80. More airline pilots had submitted an aviation safety report than had collegiate aviation students in this study.

Table 3
Number of study participants that had submitted an aviation safety report

	Students		Airline Pilots	
Safety Report Submission	Value	Percentage	Value	Percentage
Yes	4	6.8%	107	83.6%
No	55	93.2%	20	15.6%
Total	59	100%	127	99.2%

Note. One participant from the pilot group did not respond to this question.

Respondents indicated a significant difference in their perception of the confidentiality of an aviation safety report once it is submitted. Collegiate aviation students (M = 3.44, SE = .13) had significantly lower confidence in a report's ability to remain confidential than do airline pilots (M = 3.90, SE = .11). This difference, -0.46, BCa 95% CI [-.795, -.117], is significant t(142) = -2.493, p = .014, resulting in a small effect, r = .20. In this study, airline pilots had slightly higher confidence in the ability of an aviation safety report to remain anonymous.

Closer examination of two possible sub-factors which influenced the perception of reporting confidentiality may provide insight into collegiate aviation students' lower reporting rate when compared to airline pilots in this study. When surveyed regarding the ability to report safety discrepancies without fear of negative consequences, there is no significant difference between collegiate aviation students (M = 3.78, SE = .11) and airline pilots (M = 4.01, SE = .10), a difference of 0.23, BCa 95% CI [-.531, .088], t(142) = -1.401, p = .163, r = .19. Willingness of the two groups to file an aviation safety report if the event was caused by their own actions showed a significant difference. Collegiate aviation students (M = 3.29, SE = .12) were less likely to file a report under these circumstances than airline pilots (M = 3.74, SE = .09), a difference of -0.45, BCa 95% CI [-.776, -.131], t(142) = -2.779, p = .006, r = .23. These sub-factors may provide some insight into the lower reporting rate of collegiate aviation students.

Frequency of Safety Report Submission

The previously mentioned findings may also impact the frequency of aviation safety report submission, measured here by the number of times a respondent had filed a report. Collegiate aviation students filed fewer safety reports (M = .09, SE = .04) than airline pilots (M = 3.44, SE = .20), a significant difference of -3.35, BCa 95% CI [-3.73, -2.92], t(132) = -16.530, p = .000, and represents a large effect, r = .80 for the two groups included in this study. The lower incidence of collegiate aviation student safety report submission is further confounded by the number of perceived safety-related issues witnessed. Respondents were asked to indicate the number of perceived safety-related issues witnessed in a four-month period for airline pilots or semester for students (Figure 1). Perceived safety-related issues witnessed by collegiate aviation students (M = 3.85, SE = .14) was slightly higher than airline pilots (M = 3.79, SE = .08) during this time period, an insignificant difference of .067, BCa 95% CI [-.282, .391], t(178) = .444, p = .657, representing a small effect, r = .03. While the mean for both groups lay between 11-15 and 16-20 perceived safety-related issues witnessed during the study period, the results indicated that the number of safety reports filed by collegiate aviation students was not commensurate with the number of perceived safety-related issues witnessed (Figure 2).

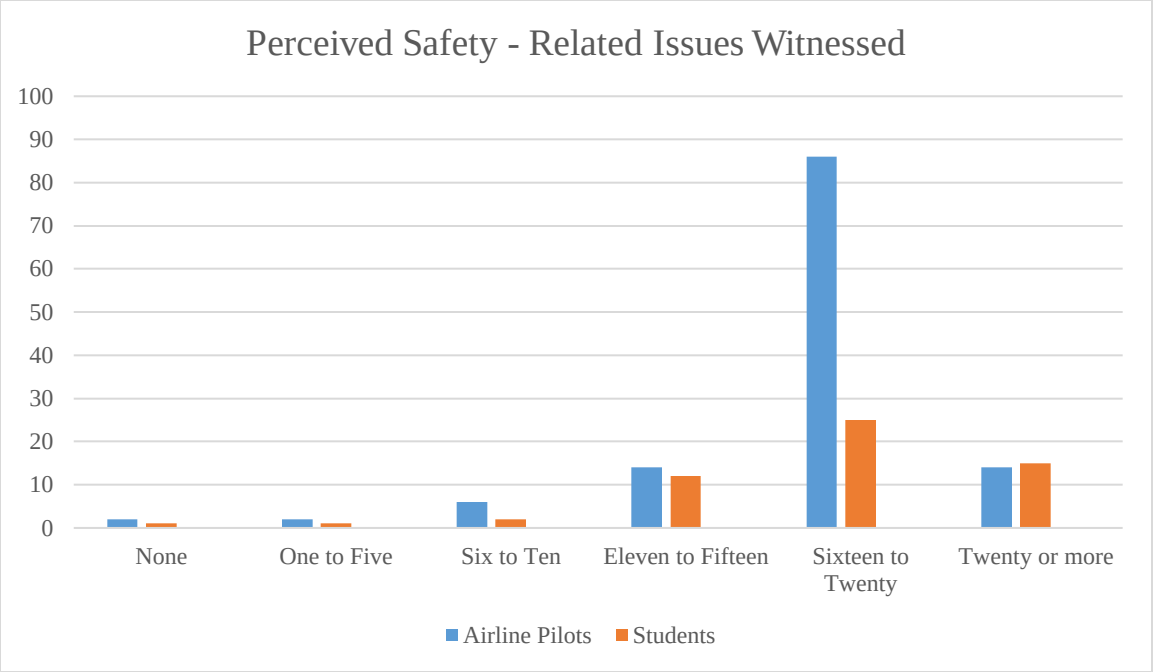

Figure 1. Perceived safety-related issues witnessed

Note. For safety-related issues witnessed, participants were selected from a scale of six items. Selection "0" corresponds with "None," "1" corresponds with "1-5," etc. See Appendix A.

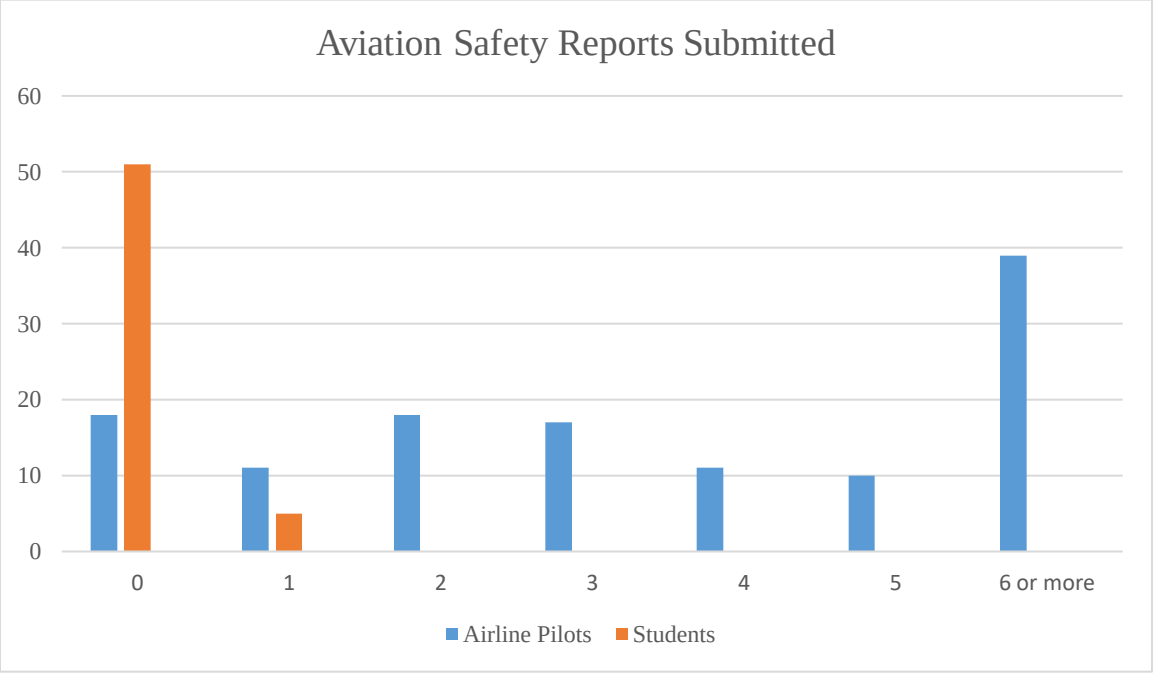

Figure 2. Aviation safety reports submitted

Effectiveness of Safety Policies and Procedures

Study participants were asked their perceptions of the effectiveness of safety policies and procedures in effect at their organization. Collegiate aviation students (M = 3.93, SE = .09) indicated a higher level of effectiveness of safety policies and procedures than airline pilots (M = 3.70, SE = .08), an insignificant difference of .227, BCa 95% CI [.002, .443], t(140) = 1.86, p = .064, r = .20.

Conclusions

Study findings showed that there is a difference in perceptions of aviation safety reporting systems between collegiate aviation students and airline pilots included in this research. The results indicate that there was no significant difference between collegiate aviation students and airline pilots regarding the perception that safety is a core value of their respective organizations. There was also no significant difference between the two groups regarding their awareness of a safety reporting system at their respective organization. The number of perceived safety-related issues witnessed over the study period was not significantly different between the two groups, but there was a significant difference in the number of safety reports submitted by each group. Airline pilots reported at a higher rate than collegiate aviation students. While we conclude from the results that the frequency of safety report submission did not solely depend on the number of perceived safety-related issues witnessed, the number of issues witnessed contributed to a respondent's perception of the effectiveness of safety policies and procedures at their respective organization. For the collegiate aviation program included in this study, we also conclude from the results that student safety reporting is influenced by a perceived lack of report confidentiality by students in this program

Discussions

Two important findings stand out from the research results regarding the differences in perception of aviation safety reporting systems between collegiate aviation students and airline pilots included in this study. First, there were no significant differences between collegiate aviation students and airline pilots regarding awareness of an aviation safety reporting system within their organization. It was expected that airline pilots would have a heightened awareness of such a system due to their additional exposure to and training as to its use. This may be the result of a robust aviation safety reporting system being present within the single collegiate aviation program surveyed in this study or an isolated event. This is an important positive finding that collegiate aviation students were aware of an aviation safety reporting system. The second was the finding that collegiate aviation students participating in this study, while having an awareness of an available aviation safety reporting system roughly equal to that of airline pilots, reported at a significantly lower rate. Three sub-areas were identified and analyzed to gain a deeper insight into this finding, two of which were significant: student impression that their reports would not remain confidential and a reluctance to file a report about an unsafe condition that was caused by their own actions.

One reason cited by the collegiate aviation student respondents in this study for the lower reporting rate was the difference in perception of confidentiality safeguards present within their aviation safety reporting system. This finding is reported in the Safety Reporting subsection of the Results section of this paper. It is possible that the ASRS reporting system that collegiate aviation students are most familiar with is relied upon to de-identify the data in an incoming report and does not have the confidentiality benefit of airline ASAP report data that is de-identified before it gets to ASRS. This is one possible explanation for the lower reporting rate of collegiate aviation students.

The collegiate aviation respondents were comprised of students from both the maintenance management and professional pilot concentrations. Regardless of concentration or curriculum requirements, receptacles exist in both the maintenance and flight schools for the anonymous submission of safety reports in the study collegiate aviation program. Students in the collegiate aviation program may have classes together, and the details of a reported safety event may quickly become common knowledge throughout the department. This may provide another explanation for the lower reporting rate of collegiate aviation students: a smaller, geographically concentrated population making anonymity difficult as compared to a larger, geographically dispersed population for airline pilots.

Further examination of safety report frequency showed that students and airline pilots witnessed similar numbers of perceived safety-related issues during the study period. This finding suggests that the frequency of safety report submission is not solely dependent on the number of perceived safety-related issues witnessed. Collegiate aviation students and airline pilots both indicated similar perceptions of the effectiveness of safety policies and procedures in their respective organizations. The general trend in each group showed that the perception of the effectiveness of safety policies and procedures tend to decrease with an increase in the number of perceived safety-related issues witnessed. These findings suggest that students may not view safety reporting as an integral component of safety management and the safety culture of their organization and may not have internalized their status as a member of that safety culture. Behavior such as this could provide an indicator as to the robustness of the organizational safety culture and the view that "…the safety department does not own safety, rather it is owned by every employee" (Stolzer et al., 2013, p. 29).

Limitations

The selection of a single collegiate aviation program, single U.S. FAR 121 air carrier, and limited period for data collection were all limitations of this study. Thus, the ability to generalize findings beyond these two entities is limited. However, the analytical process described in the following paragraphs would be applicable to different airline and collegiate aviation groups. The authors do not assume, stated or implied, that there was a safety reporting deficiency on the part of either group included in this study, but that there is a difference in experience level and operating environment between the two groups that explained any difference. As a self-reporting tool, an aviation safety report is subject to the bias of the reporter, primarily self-reporting bias and recall bias (Lyle, 2020).

The authors assumed that one of the primary objectives of collegiate aviation education and training is to prepare students for careers in professional aviation. This assumption was validated by Carney (2014) and the input of industry partnerships that influence AABI accreditation criteria. Professional pilot and maintenance management collegiate aviation students were intentionally selected for two reasons: they were the two largest concentrations in the program studied and were most likely to be covered by an aviation safety reporting system in professional practice.

Recommendations

One purpose of collegiate aviation training and education is to prepare a student to enter the professional aviation workforce. To achieve this goal, a student should be trained to industry standards of which safety is a large component. Aviation program accreditation seeks to promote this educational process. This study found several areas where the collegiate aviation department studied was congruent with the industry, and areas where it differed from industry practice. One such finding is the lower safety report submission rate for collegiate aviation students, the concern for report confidentiality cited as a reason by respondents. Perhaps the structure and confidentiality procedures of an airline ASAP program are scalable to the collegiate aviation environment (FAA, 2003, 2020a). A safety report could be submitted online to an entity not directly involved with the operation of the collegiate aviation program, such as the Aviation Accrediting Board International (AABI) or University Aviation Association (UAA). The AABI Safety Committee defines its mission to "…provide guidance…about safety matters related to AABI criteria…and safety matters related to a safety management approach to fostering an effective safety culture in aviation programs" (AABI, 2018). The report would undergo a review similar to an ASAP report but tailored to the collegiate aviation environment, and feedback provided to the affected aviation program for review and mitigation. Access to this data could be limited to departmental faculty or safety officers responsible for safety areas for confidentiality. An additional benefit would be the establishment of a database by the collecting entity to analyze and identify overall collegiate aviation safety trends of member departments. This trend analysis allows for a proactive approach to safety, identifying and mitigating risk before it rises to the level of a hazard, and reflects industry-standard practice in professional aviation.

Directions for Future Research

Administrators, instructors, and students must actively work toward industry-standard safety practices, evoking all sentiments of laboriousness associated with change management (Simon & Cistaro, 2009). To implement the changes necessary to address the safety-related issues found in this study, future data collection could include multiple collegiate aviation programs. Through the study of multiple programs, researchers should be able to validate trends related to safety perceptions found in this study or determine that the results of this study are germane to the single collegiate aviation program included here. In addition to the quantitative method used here, a qualitative component could be added to enable a richer understanding of survey responses. It would also be beneficial to survey students regarding the benefits of an aviation safety course and how it would affect a student's perception of safety reporting and

safety culture. The survey instrument used here could also be replicated at other major and regional airlines to collect and analyze data from a more operationally diverse population employed in professional aviation.

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