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COLLEGIATE PROGRAM SAFETY CULTURE SURVEY – A COMPARISON OF DISCIPLINES

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The use of safety culture surveys to determine constituent perception of an organization's efforts toward safety is widely accepted. However, the use of such surveys to compare disciplines within a collegiate aviation department has infrequently been employed. Students enrolled in flight, maintenance, and UAS programs participated in a safety culture survey, providing data on the safety culture within each program as well as the ability to compare programs. Subscales for safety values, safety fundamentals, and risk assessment were included. There were statistically significant differences in safety values between the maintenance group and both the flight and UAS groups, and between all three groups in safety fundamentals, but no statistically significant difference between programs in risk assessment.

In an effort to understand areas of strength and weakness, an inaugural safety culture survey was conducted of students in the flight, maintenance, and unmanned aircraft systems operations (UAS) programs of a collegiate aviation department. In addition to establishing a baseline perception of safety culture, differences between the responses of the students in the different programs were examined. While there have been previous studies comparing functional areas within companies, there has been little work examining differences between functional areas in an academic environment. Although all three programs are located within the same department, sub-culture development was felt to be likely, impacting student perceptions of safety culture.

Literature Review

Several studies (Clarke, 2006; McDonald, Corrigan, Daly, & Cromie, 2000; Varonen & Mattila, 2000) have confirmed the relationship between the employee perception of safety culture and the level of safety actually experienced within an organization. Thus, safety culture surveys serve as tools to direct efforts toward continuous improvement. There is now a significant body of research on safety culture in aviation; a 2011 study reviewed 23 safety culture surveys which had been utilized in military and commercial aviation organizations (O'Connor, O'Dea, Kennedy, & Buttrey, 2011). Although early studies tended to focus on a particular area of operations (i.e., flight, maintenance, cabin crew), several have concentrated on the variations found between operations within an organization. Patankar (2003) found significant differences between flight operations and maintenance personnel at a US company. Gao et al. (2015) found that while the overall safety climate across four groups (flight crew, cabin crew, mechanics, and ground operations staff) was positive, there were also significant differences between occupational groups.

As collegiate aviation programs embrace safety management system (SMS) concepts, they are looking to safety culture surveys to understand how well their efforts are being received.

In the largest study of safety culture at collegiate flight schools to date (Robertson, 2017), the Collegiate Aviation Program Safety Culture Survey (CAPSCUS) was completed by students and employees at 13 collegiate flight schools across the US. This study found a correlation between positive safety culture survey results and the degree of SMS implementation, level of safety promotion, and management commitment to safety at the collegiate level. Based on these findings, Robertson argued for the value of using safety culture surveys as both a baseline measure and as an ongoing indication of the effectiveness of a collegiate institution's SMS implementation efforts. There has been considerably less work done in areas outside flight training at the collegiate level. However, a 2016 study (Adjekum et al.) looked at aviation management, air traffic control, and UAS students' perception of safety culture. The study found that non-flight majors have "different areas of emphasis" (Adjekum, et al, 2016, p. 17) within the safety culture than do flight majors within the same department. It is this difference between programs that is of particular interest in this study.

Methodology

There have been numerous versions of safety culture surveys utilized over the past 15 years. These in large part have been developed from previously existing surveys, to meet the needs of the organization conducting the survey. This study is no exception to that precedent, with most survey questions based on the previously used CAPSCUS collegiate safety culture study (Adjekum, 2013; Robertson, 2017). The survey consisted of a series of Likert-type scale questions, divided into subscales of departmental safety values, safety fundamentals, and risk assessment of both participants themselves and their view of others. Note, three separate surveys were distributed, reflecting the appropriate program terminology (i.e., flight, maintenance, or UAS) although the questions displayed in Table 1 use generic phraseology. As a human subject research project, permission to conduct this survey was granted by the university's Institutional Review Board. In the spring 2018 semester, all students in the programs of interest received an e-mail from the department chair, requesting that they participate in the safety culture survey and providing a link to the electronic survey. Three days after the initial e-mail a follow up e-mail was sent, and four days later, the survey was closed. The survey was conducted anonymously, with no identifying information recorded.

Results

The 507 students enrolled in the flight, maintenance, or UAS operations program in the spring 2018 semester were the population for this study. The flight program had 370 students, maintenance had 81 students, and UAS had 56 students. A total of 188 responses were collected, representing 37% of the total population of students in the three programs of interest. There were 127 (67.5%) respondents enrolled in the flight program, 37 (19.7%) in the maintenance program, and 24 (12.8%) in the UAS program. The disparity in sample sizes is due to the imbalance in the number of students enrolled in each program. For instance, the flight program is the largest in the department, exceeding other concentrations by around 300 students. However, when the number of respondents in each program is compared to the population of each program, the response rates were 34% for flight students, 46% for maintenance students, and 43% for UAS students. Furthermore, the respondents comprised of 47 (25%) freshmen, 57 (30.3%) sophomores, 44

(23.4%) juniors, 39 (20.7%) seniors, and 1 (< 1%) graduate student. The means and standard deviations for each question, by program, can be seen in Table 1.

Table 1
Survey Questions and Descriptive Statistics

<i>Scale: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5)</i>	Flight	Maint.	UAS
SAFETY VALUES	Mean (SD)	Mean (SD)	Mean (SD)
1. Safety is a core value of the Aerospace Department.	4.57 (.89)	4.00 (.97)	4.71 (.69)
2. The Aerospace Department is more concerned about making money than being safe. (Reverse ¹)	3.82 (.98)	4.06 (.86)	4.08 (1.0)
3. The Aerospace Department does not show much concern for safety until there is an accident or incident. (Reverse ¹)	4.25 (.70)	3.97 (.88)	4.29 (.86)
4. The Aerospace Department does not cut corners where safety is concerned.	4.14 (1.0)	3.59 (.98)	4.25 (.99)
5. The Aerospace Department goes above and beyond regulatory minimums when it comes to issues of safety.	4.19 (.82)	3.54 (1.0)	4.52 (.73)
6. The Aerospace Department tries to get around safety requirements whenever the chance presents itself. (Reverse ¹)	4.17 (.90)	4.08 (.76)	4.17 (.94)
7. Aerospace Department senior personnel view regulation violations very seriously, even when they do not result in any serious damage or injury	4.27 (.78)	3.68 (1.1)	4.33 (.96)
SAFETY FUNDAMENTALS			
8. Checklists and procedures are easy to understand.	4.36 (.71)	3.54 (1.2)	4.21 (.98)
9. The safety practices and procedures manual is carefully kept up to date.	4.21 (.66)	3.35 (1.3)	4.18 (.73)
10. The Aerospace Department is willing to invest money, resources, and effort to improve safety.	3.89 (.87)	3.75 (1.1)	4.42 (.83)
11. The Aerospace Department is committed to equipping aircraft with up-to-date technology.	3.91 (.94)	NA	NA
12. Instructors have a clear understanding of risks associated with specific operations.	4.29 (.70)	4.27 (.69)	4.87 (.34)
13. Safety is consistently emphasized during training.	4.41 (.65)	3.81 (.91)	4.78 (.42)
14. Instructors teach shortcuts and ways to get around safety requirements. (Reverse ¹)	4.00 (.81)	3.97 (1.0)	4.45 (.91)
15. The Aerospace Department ensures that maintenance on aircraft is adequately performed.	4.00 (.88)	NA	NA
16. The Aerospace Department ensures that aircraft are safe to operate.	4.17 (.73)	NA	NA
17. The Aerospace Department safety reporting system is convenient and easy to use.	4.20 (.75)	3.97 (1.1)	4.26 (.92)
18. Students are actively involved in identifying and resolving safety concerns.	4.00 (.82)	3.38 (1.2)	4.43 (.95)
19. Safety is consistently emphasized in all stages of practical training.	4.41 (.65)	3.81 (.91)	4.78 (.42)
Risk Assessment of SELF (students asked to rate frequency they experienced the following):²			
<i>Scale: never (1), once in the last six months (2), two to four times in the last six months (3), and five or more times in the last six months (4).</i>			
20. Reported for a flight lesson when fatigued, ill, or under unusual stress because you felt you had no other choice?	1.48 (.82)	NA	NA
21. Were pressured to conduct a flight (or lab) in what you believed to be unsafe weather or environmental conditions?	1.17 (.42)	1.05 (.33)	1.04 (.21)
22. Were pressured to fly an aircraft you believed was in an unsafe mechanical condition (flight); unsafe equipment (Maint., UAS)?	1.24 (.63)	1.17 (.56)	1.00 (.00)
23. Failed to challenge more senior personnel (instructor or management personnel) on a safety issue for fear of being penalized in some manner?	1.07 (.26)	1.11 (.39)	1.04 (.21)
24. Made a hard landing that you did not report?	1.24 (.56)	NA	NA
25. Were aware of a safety issue but did not file a safety report?	1.26 (.48)	1.38 (.79)	1.09 (.29)
26. Were aware of another student acting in an unsafe manner but you did not file a safety report?	1.43 (.56)	1.28 (.83)	1.22 (.52)
27. Allowed an instructor or senior pilot's error to go unchallenged?	1.14 (.35)	NA	NA

Note: 1: "Reverse" indicates the question was worded in the negative to check and correct for student inattention to questions. Results indicated have been reversed to the positive so sub-scale statistics could be calculated. 2: The risk assessment questions were also asked as an assessment of "others" but are not repeated here due to space constraints.

Statistical Analysis for Research Question 1

Are students' perceptions of the safety value, safety fundamentals, and risk assessment scales consistent with their view of "safety is a core value"?

It was our objective to determine if the perception of safety was consistent across all scales. To accomplish this analysis, an ANOVA was conducted on the mean scores for each scale. The mean score was used because the number of items in each scale varied, negating the

ability to use summated scores. The scores for “safety is a core value of the Aerospace Department” were not combined with any other scales and was analyzed independently. The data met the assumption of normality, but the assumption of homogeneity of variance was not met. The result of the Levene’s test was $F(4) = 15.09, p < 0.05$. Welch’s ANOVA was applied to the data to adjust for differences in group variances, as this test is not sensitive to unequal variances (Jan & Shieh, 2014). The result of Welch’s ANOVA was statistically significant, Welch’s $F(4, 441.91) = 41.59, p < 0.05$. A Tukey post-hoc test showed statistically significant differences ($p < .05$) among all scales when compared to the perception of safety as a core value ($M = 4.48, SD = .91$). The mean for the safety value scale was 3.71 ($SD = .48$), the mean for the safety fundamental scale was 3.93 ($SD = .51$), and the mean for the risk assessment scale was 4.06 ($SD = .26$).

Statistical Analysis for Research Question 2

Are there statistically significant differences in the perceptions of safety among students in different programs?

Our second objective was to determine any statistically significant differences in the perception of safety as a core value among the three programs selected for this study. The data met the assumption of normality and the assumption of equal variances. A one-way ANOVA was performed on the data, and the result was statistically significant: $F(2, 185) = 7.01, p < .05$. A post hoc analysis using the Tukey HSD test revealed that the mean for the flight group ($M = 4.57, SD = .89$) was statistically different than the mean for the maintenance group ($M = 4.0, SD = .97$). However, the difference between the flight and UAS groups was not statistically significant ($M = 4.71, SD = .69$). Additionally, there were statistically significant differences between the maintenance group and both the flight and UAS groups. Furthermore, the differences among the concentrations on the three other scales were tested. The result of the ANOVA for the safety value scale was statistically significant: $F(2, 184) = 5.49, p < .05$. The results of the post hoc analysis using the Tukey HSD test was similar to the previous result of safety as a core value, indicating that the mean of the maintenance group ($M = 3.82, SD = .67$) was statistically different than the means of both the flight group ($M = 4.13, SD = .54$) and the UAS group ($M = 4.28, SD = .72$). Similarly, there was no statistical difference between the UAS group and the flight group. For the safety fundamentals scale, the result of the ANOVA was also significant: Welch’s $F(2, 49.6) = 11.61, p < .05$. However, the Tukey HSD post hoc test revealed statistically significant differences between all groups with the mean of the maintenance group as the lowest ($M = 3.76, SD = .70$), the UAS group with the highest ($M = 4.48, SD = .45$), with the flight group in the middle ($M = 4.18, SD = .48$). Finally, the risk assessment scale differed from the previous results in that no statistically significant differences were found among the three groups, $F(2, 182) = 1.97, p = .143$. The means for the groups are as follows: maintenance ($M = 4.77, SD = .40$), flight ($M = 4.80, SD = .29$), and UAS ($M = 4.92, SD = .13$).

Discussion

Overall, students in all programs of the department had a favorable perception of safety as a core value; however, their perceptions of aspects of safety across the other scales were lower. If safety is a core value of an organization, it should be reflected in all aspects of operation, with no statistical significance between safety as a core value and the other scales. The

results also suggest that there is a disconnect between perceiving safety as a core value and understanding safety programs. Safety as a core value should be supported in practice. Two possible explanations for this disparity are posited. First, students may not have a fully developed understanding of SMS. They believe safety is a core value, but fail to make a logical connection to what they see in practice. Second, emphasis of safety through verbal and written communications to students may lead to higher perceptions of safety as a core value.

Additionally, among the three groups, maintenance had the least favorable perception of safety as a core value with statistically significant differences between maintenance and the other two groups. This is also true for the safety value and safety fundamentals scales. It is expected that students within the same department, under the same oversight, and operating with similar safety policies and requirements should have similar perceptions of safety, but this is not the case. Sub-cultures may explain the differences in perceptions of safety, as one of the factors of sub-culture development is geographical separation (Boisnier & Chatman, 2002). Maintenance, flight, and UAS programs all conduct a portion of their training on satellite campuses.

There is one scale in which there was no statistical difference among the three programs: risk assessment. Questions in the risk assessment scale are introspective—measuring one's own actions—while the other scales measure of the actions of the department. Taken together, this reveals that, irrespective of the program, students behave and act in similar ways regarding safety matters. However, the difference lies in how each program manages safety.

Conclusion

As discussed above, this study indicated that the safety culture in the department is perceived as positive by students in each program, but somewhat diverse results were obtained between the groups. Although all students in the department have 13 credit hours of aviation coursework in common, that core is so small relative to the total number of aviation credit hours required that different safety sub-cultures appear to develop within each concentration. The industry backgrounds of faculty in each program likely impact the development of these sub-cultures. Additionally, the time since instigation of SMS concepts within programs appears to have a strong impact on student perception of safety culture. The flight program was the first in the department to embrace SMS concepts, with that effort now over a decade old. The maintenance program SMS efforts began in earnest three years ago, and while progress is being made the perceptions of safety culture by students in this program currently lags slightly behind the flight and UAS program students. The UAS program is very different from the two other programs. As a young program which was developed after the tenets of SMS were widely understood in the industry, it was designed with these concepts built into every facet of operation. In summary, the longevity of efforts to implement SMS, as well as the impact of the faculty members within each program, appears to be greater than the influence of the department administration as a whole on student perception of safety culture.

Recommendations for Future Studies

Even though the response rate was relatively strong, it would be beneficial to repeat the study with stronger encouragement for students to participate. This study was a cross-sectional

approach but in the future, it is anticipated that a slightly modified instrument will be utilized annually to provide a longitudinal approach. Finally, repetition of the survey by other collegiate aviation institutions is encouraged, as the further comparison of differences between programs within the same university may lead to an understanding of how to assist various programs in improving their safety culture.

References

- Adjekum, D. K. (2013). *Safety culture: An assessment of a collegiate aviation program* (Master's thesis).
- Adjekum, D. K., Keller, J., Walala, M., Young, J. P., Christensen, C., Demik, R. J., & Northam, G. J. (2015). Cross-sectional assessment of safety culture perceptions and safety behavior in collegiate aviation programs in the United States. *International Journal of Aviation, Aeronautics, and Aerospace*, 2(4), 1-34.
- Boisnier, A., & Chatman, J. A. (2003). The role of subcultures in agile organizations. In R. Petersen, & E. Mannix (Eds.), *Leading and managing people in dynamic organizations*. Mahwah, NJ: Psychology Press.
- Clarke, S. (2006). The relationship between safety climate and safety performance: a meta-analytic review. *Journal of Occupational Health Psychology*, 11(4), 315– 327.
- Gao, Y., Bruce, P.J., & Rajendran, N. (2015). Safety climate of a commercial airline: A cross-sectional comparison of four occupational groups. *Journal of Air Transport Management*, 47, 162-171.
- Jan, S., & Shieh, G. (2014). Sample size determinations for Welch's test in one-way heteroscedastic ANOVA. *British Journal of Mathematical and Statistical Psychology*, 67, 72-93.
- McDonald, N., Corrigan, S., Daly, C., & Cromie, S. (2000). Safety management systems and safety culture in aircraft maintenance organization. *Safety Science*, 34, 151– 176.
- O'Connor, P., O'Dea, A., Kennedy, Q., & Buttrey, S. E. (2011). Measuring safety climate in aviation: A review and recommendations for the future. *Safety Science*, 49, 128-138.
- Patankar, M. S. (2003). A study of safety culture at an aviation organization. *International Journal of Applied Aviation Studies*, 3(2), 243–259.
- Robertson, M. F. (2017). *Examining the relationship between safety management system implementation and safety culture in collegiate flight schools* (Doctoral dissertation).
- Varonen, U., & Mattila, M. (2000). The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis Prevention*, 32(6), 761-769.