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Effect of a Safety Event on Perceptions of Safety Culture in Collegiate Flight Training

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Abstract: A collegiate aviation flight program experienced a series of engine-related issues, leading to the grounding of the entire single-engine fleet. Students' perceptions of safety culture were analyzed using data from the program's annual safety culture perception surveys. Data from before and after the safety event showed that five survey items on the safety culture perception survey indicated a positive statistically significant change, while one item showed a negative statistically significant change. Perceptions of lowerclassmen and upperclassmen were also analyzed to determine if there was any variance between the two groups. Results indicated that only one survey item was statistically significant.

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Introduction

In the fall of 2024, a large collegiate flight school with over 600 flight students grounded all single-engine training aircraft due to engine issues that led to "a partial loss of engine power" (Donnelly, 2024). The issue was a faulty fuel servo, and even though it is a relatively small component in the engine, it caused an outsized problem. Eventually, almost all 44 single-engine aircraft were found with contaminated fuel servos (Donnelly, 2024). Due to issues in acquiring parts and a manufacturer's denied request to outsource the parts, the entire fleet was grounded for almost two months. Prior to the fleet grounding, there were multiple reports of engine issues. A common manifestation of the engine issue was losing power in flight, engine roughness, oil pressure abnormalities, and engine failure.

The decision to ground the fleet, thus affecting students' training progress, was made in the interest of safety, and the director of the program expressed a strong focus on safety and the continuous airworthiness of training aircraft (Donnelly, 2024). Safety actions taken during this time by management included grounding the fleet, openly communicating issues and progress with students and staff, and increasing maintenance staff to ensure the safety and airworthiness of training aircraft (Donnelly, 2024). The issue was resolved and the training aircraft returned to service in late 2024. An annual safety culture perception survey was distributed to all students in spring 2025.

Evaluating safety culture perception data following a safety event is critical in providing management the ability to adjust safety policies to improve safety culture (Byrnes et al., 2022). Byrnes et al. (2022) found that the safety culture and climate perceptions in a collegiate flight school were reduced during a safety crisis (COVID-19). Similarly, our study examined the impact of the string of engine issues and the subsequent actions taken by the management team on students' perceptions of safety culture in a collegiate aviation flight school. Safety culture perception survey results before the safety event and after the safety event were analyzed to determine if there was a change in students' perceptions of safety culture, and if so, was the change positive or negative.

Research Questions

Research Question 1: Did the actions taken by management during the safety event affect students' perception of safety culture?

Null hypothesis: There is no difference in students' perception of safety culture.

Research Question 2: Is there a difference of the perception of safety culture between lowerclassmen (freshmen and sophomores) and upperclassmen (juniors and seniors)?

Null hypothesis: There is no difference in the perception of safety culture between lowerclassmen and upperclassmen.

Literature Review

Organizational culture is defined as "the set of shared values and norms that control organizational members' interactions with each other and with suppliers, customers, and other people outside the organization" (Jones & Mathew, 2018, p. 188). Importantly, organizational culture "controls the way members make decisions" (Jones & Mathew, 2018, p. 188). Organizational culture and safety culture are inextricably linked: Safety culture is generally considered as a subset of organizational culture (Goodheart, 2017). Thus, in the context of aviation safety management, an organization that values safety will incorporate safety values into its policies and practices, and safety will be supported by management (International Civil Aviation Organization [ICAO], 2018). The result of management's actions will be perceived by front-line employees, as they feel the shared responsibility of fulfilling the organization's safety objectives (ICAO, 2018). There is also a high level of trust among employees of all levels and ranks (ICAO, 2018). Positive safety cultures have a direct impact on an organization's safety performance (ICAO, 2018; Kim et al., 2019).

Safety culture is not stagnant. There are many factors that can cause safety culture to change or shift—in a positive or negative direction—and one prominent factor is the role of management in cultivating a positive safety culture (Byrnes et al., 2022; ICAO, 2018). Management can foster a positive safety culture by their actions, such as demonstrating a commitment to safety, being adaptable, and maintaining awareness of risks (ICAO, 2018).

Culture change can be driven by internal and external forces (Cummings & Worley, 2007), such as safety events, organizational changes, and systems changes (Byrnes et al., 2022). Measuring safety culture in an organization should be a component of safety management efforts (Goodheart, 2017). An initial assessment of safety culture provides the safety practitioner with a baseline understanding of the safety culture, and it is the first step to developing organizational safety culture (Wheeler et al., 2019). However, safety culture evaluations do not stop there. Continuous safety culture assessments are also crucial in monitoring how safety culture is affected by various forces (Byrnes et al., 2022).

Safety culture measurements are used in many industries, including aviation, as a component of managing safety and controlling risk (Robertson, 2016; Tear et al., 2020). There are many ways to measure safety systems, such as accident records, audits, and safety culture perception surveys (Byrnes, 2022; Goodheart, 2017). Understanding safety culture perceptions is important, as safety culture perceptions affects safety behavior (Adjekum et al., 2015; Tear et al., 2020) and is one of the predictors of safety reporting behavior (Byrnes, 2022). Many safety culture studies have been conducted in collegiate aviation, many of which utilize safety perception surveys (e.g, Adjekum, 2014; Anderson et al., 2024; Beckman et al., 2019; Robertson, 2016). Various surveys have also been developed or adapted for use in collegiate aviation safety culture studies: The Collegiate Aviation Program Safety Culture Assessment Survey (CAPSCAS) was modified from the Commercial Aviation Safety Survey (CASS; von Thaden & Gibbons, 2008), which was modified by Adjekum (2014). Another derivative of CASS is the Safety Culture Indicator Scale Measurement System (SCISMS; Anderson et al., 2024).

While safety culture perception surveys are important components of cultivating a positive safety culture, the information learned from surveys requires management action. Management commitment to safety is crucial in fostering a positive safety culture. Management must model safe practices, which eventually becomes the norm for the organization (ICAO, 2018). In ICAO's Safety Management Manual (2018), there are six elements of management and employee actions that either promote or degrade safety culture, but of those six, four are of interest to our study. The elements, along with some of its positive aspects, are reported below:

> Commitment to Safety: Management leads safety culture and is actively motivating its employees to care for safety, not only by talking but by acting as role models.
>
> Adaptability: Employee input is actively encouraged when addressing safety issues; all incidents and audit findings are investigated and acted upon; organizational processes and procedures are questioned for their safety impact; and a clear proactive approach to safety is demonstrated and followed.
>
> Awareness: Investigators seek to establish the root cause; and the organization systematically evaluates if safety improvements are implemented and working as intended.
>
> Behaviour [*sic.*] with respect to safety: Continuous monitoring of safe behaviour [*sic.*] is practised [*sic.*]; and the working conditions support aviation safety at all times. (ICAO, 2018, pp. 3-5, 3-6)

Methodology

This study used questions extracted from the CAPSCAS as it related to students' perceptions of management's safety commitment. This is a validated survey instrument (Adjekum, 2014; von Thadden & Gibbons, 2008). This study was approved by the IRB, and data for this study were collected at the end of the spring 2024 semester and the end of the spring 2025 semester. This is an annual survey sent to all students in the department, including students who are not professional flight. The rationale behind sending it to all students instead of flight students only is because some of the management students switched from professional flight. Those who switched from professional flight to management were invited to participate if they have conducted some flight training at the flight school. Initial screening questions prevented management students who have never conducted training at the flight school from completing the survey. Those who indicated that they were not professional flight students were asked a follow-up question: "Have you conducted any flight training at the university's flight school." Students who selected "Yes, I have conducted flight training at the university's flight school" were allowed to continue the survey.

The administration of this survey is part of the effort to ensure continuous improvement and assessment of safety culture. A request to participate in completing the survey was sent to all students and participation was voluntary. No student information was tracked. This study was approved by the IRB. Survey results were downloaded from Qualtrics, and statistical analyses were conducted using *R*.

Results

For both 2024 and 2025, there were over 800 total students in the department with over 600 students enrolled in flight. For 2024, 102 students started the survey, and 64 completed the survey. For 2025, 113 students started the survey, and 75 completed the survey. Many participants started the survey but were prevented from continuing past the initial screening questions. These participants were presumed to be management students who have conducted no flight training at the university. See Table 1 for a breakdown of the classification of participants.

Table 1

Classification of Participants

Classification	2024		2025	
	n	%	*n*	%
Freshman	5	8%	17	23%
Sophomore	12	19%	21	28%
Junior	13	20%	12	16%
Senior	34	53%	25	33%
Total	64	---	75	---

Research Question 1

Research Question 1: Did the actions taken by management during the safety event affect students' perception of safety culture? Responses from 2024 and 2025 were analyzed. Normal distribution was assumed based on the central limit theorem (Sheposh, 2024; West, 2021). Welch's two sample *t*-tests were used for analysis. Welch's *t*-test does not assume homogeneity of variance (Derrick et al., 2016; West, 2021). Participants rated their agreement to the statements for items 1 – 18: 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree. For items 19 and 20, participants rated the frequency of the statement: 1 for never, 2 for once in the last six months, 3 for two to four times in the last six months, 4 for five to ten times in the last six months, and 5 for more than ten times in the last six months. There were four questions in the survey that contained negatively worded statements. These questions were reverse-coded: Questions 4, 5, 6, and 18 (see Tables 2 and 3). Table 2 presents the findings of this analysis.

Table 2

Independent t-tests for Research Question 1

No.	Item	2024 [1]		2025 [2]		Difference
		M	*SD*	*M*	*SD*	[2] – [1]
1	Pilots can report safety discrepancies without fear of negative consequences	3.45	1.30	3.81	1.19	0.36
2	When pilots make a mistake or do something wrong, they are dealt with fairly by management	2.85	1.11	3.00	0.97	0.15
3	Safety is a core value of the program	3.56	1.15	4.06	1.16	0.50* [a]

4	Management is more concerned with making more money than being safe (reverse)	2.44	1.24	2.93	1.26	0.49* [b]
5	Management expects pilots to push for on time performance, even if it means compromising safety (reverse)	2.53	1.24	2.55	1.27	0.02
6	Management doesn't show much concern for safety until there is an accident or incident (reverse)	2.62	1.21	3.10	1.29	0.48* [c]
7	Management does not cut corners where safety is concerned	3.10	1.04	3.32	1.05	0.22
8	Safety issues raised by pilots are communicated regularly to all other pilots in this program	2.48	1.36	2.99	1.19	0.51* [d]
9	When a pilot reports a safety problem, it is corrected in a timely manner	3.05	0.98	3.14	0.99	0.09
10	Pilots are satisfied with the way management deals with safety reports	2.73	0.99	3.06	1.05	0.33
11	The flight school is willing to invest money, resources, and effort to improve safety	3.27	1.25	3.70	1.15	0.43* [e]
12	The flight school is committed to equipping aircraft with up-to-date technology	4.63	0.61	4.36	0.80	-0.27* [f]
13	The flight school ensures that maintenance on aircraft is adequately performed	3.23	1.48	3.48	1.21	0.25
14	The flight school ensures that aircraft are safe to operate	3.53	1.33	3.81	1.05	0.28
15	Students are actively involved in identifying and resolving safety concerns	3.33	1.20	3.46	1.04	0.13
16	Safety is consistently emphasized in all stages of practical training	3.88	1.21	4.00	1.07	0.12
17	Management goes above and beyond regulatory minimums when it comes to issues of flight safety	3.18	1.09	3.38	1.13	0.20
18	Management tries to get around safety requirements whenever they get the chance (reverse)	3.56	1.09	3.75	1.06	0.19
19	Have you ever felt pressured to fly a university aircraft you believed was in an unsafe condition?	1.34	1.34	1.45	0.83	0.11
20	Have others in the flight school ever felt pressured to fly a university aircraft they believed was in an unsafe condition?	2.21	2.21	1.90	1.38	-0.31

Note. [a] $d = 0.43$. [b] $d = 0.40$. [c] $d = 0.38$. [d] $d = 0.39$. [e] $d = 0.36$. [f] $d = 0.38$.
*Significant at 0.05. No differences were significant at 0.01 or 0.001 level.

Of the 20 questions, six questions showed significant statistical difference at $p < 0.05$. Five of the six questions showed a difference in the positive direction in that participants had a more positive perception of safety culture in 2025 than participants in 2024. Only one item had a statistically significant change in the negative direction: "The flight school is committed to equipping aircraft with up-to-date technology." Of the items that were not statistically significant, all but one question changed in the positive direction.

Research Question 2

Research Question 2: "Was there a difference of the perception of safety culture between lowerclassmen (freshmen and sophomores) and upperclassmen (juniors and seniors)?" The responses from 2025 were analyzed ($n = 75$), and the participants were divided into two groups: lowerclassmen ($n = 38$) and upperclassmen ($n = 37$). Welch's two-sample *t*-tests were conducted. Out of the twenty items, only one item was statistically significant: Item 15, "Students are actively involved in identifying and resolving safety concerns." For this question, the perceptions of the upperclassmen were lower than that of the lowerclassmen. The results of the *t*-tests are presented in Table 3.

Table 3

Independent t-tests for Research Question 2

No.	Item	Lower [1]		Upper [2]		Difference
		M	*SD*	*M*	*SD*	[2] – [1]
1	Pilots can report safety discrepancies without fear of negative consequences	3.79	1.14	3.83	1.25	0.04
2	When pilots make a mistake or do something wrong, they are dealt with fairly by management	3.00	1.03	3.00	0.93	0.00
3	Safety is a core value of the program	4.06	1.19	4.06	1.14	0.00
4	Management is more concerned with making more money than being safe (reverse)	3.06	1.17	2.80	1.35	-0.26
5	Management expects pilots to push for on time performance, even if it means compromising safety (reverse)	2.64	1.33	2.46	1.22	-0.18
6	Management doesn't show much concern for safety until there is an accident or incident (reverse)	3.28	1.30	2.91	1.27	-0.37
7	Management does not cut corners where safety is concerned	3.36	1.10	3.29	1.02	-0.07
8	Safety issues raised by pilots are communicated regularly to all other pilots in this program	3.08	1.11	2.89	1.28	-0.19
9	When a pilot reports a safety problem, it is corrected in a timely manner	3.03	0.91	3.26	1.07	0.23
10	Pilots are satisfied with the way management deals with safety reports	3.17	0.91	2.94	1.19	-0.23
11	The flight school is willing to invest money, resources, and effort to improve safety	3.83	1.10	3.56	1.21	-0.27
12	The flight school is committed to equipping aircraft with up-to-date technology	4.34	0.68	4.38	0.92	0.04
13	The flight school ensures that maintenance on aircraft is adequately performed	3.66	1.11	3.29	1.29	-0.37
14	The flight school ensures that aircraft are safe to operate	3.89	1.02	3.74	1.08	-0.15
15	Students are actively involved in identifying and resolving safety concerns	3.80	1.02	3.12	0.95	-0.68** [a]
16	Safety is consistently emphasized in all stages of practical training	4.09	1.09	3.91	1.06	-0.18
17	Management goes above and beyond regulatory minimums when it comes to issues of flight safety	3.43	1.17	3.32	1.09	-0.11
18	Management tries to get around safety requirements whenever they get the chance (reverse)	3.71	1.15	3.79	0.98	0.08
19	Have you ever felt pressured to fly a university aircraft you believed was in an unsafe condition?	1.27	0.63	1.62	0.98	0.35
20	Have others in the flight school ever felt pressured to fly a university aircraft they believed was in an unsafe condition?	1.88	1.39	1.94	1.39	0.06

Note. [a] $d = 0.69$.
*Significant at 0.05. **Significant at 0.01.

Discussion

When comparing the perceptions of safety culture between 2024 and 2025, there were five statistically significant items that changed in the positive direction, and these items saw a dramatic shift between the two years, changing anywhere from 0.43 to 0.51 on a five-point scale. Item 3, "Safety is a core value of the program," changed 0.50 between 2024 ($M = 3.56$, $SD = 1.15$) and 2025 ($M = 4.06$, $SD = 1.16$). This item surveys the overall perception of the safety culture of the program. Values are "general criteria, standards, or guiding principles that people use to determine which types of behaviors, events, situations, and outcomes are desirable or undesirable" (Jones & Mathew, 2018, p. 188). Further narrowing that definition, core value is

defined as "those ideals that form the foundation on which the organization conducts itself" (Stolzer et al., 2013, p. 206). If safety is a core value, then the organization will conduct itself with safety as a priority. This is manifest in the policies and actions taken by management.

The survey results indicate that students felt more strongly about safety as a core value in 2025 than they did in 2024. It also seems to suggest that the string of mechanical issues with the fuel servos did not lead to a negative perception of safety as a core value of the organization; instead, the actions taken by management to ground the fleet led to a more positive perception of safety as a core value. Students did not feel that the fuel servo issues were due to the organization's neglect of safety, rather, they felt that safety was more of a priority because of management's decision to ground the fleet.

In addition to a more positive view of safety as a core value, four other items also showed statistically significant differences in the positive direction. Students' perceptions that management is more concerned about safety than about cost (Item 4) and management is proactive in caring about safety (Item 6) were both more positive in 2025 than in 2024. Related to those two questions, students had a more positive perception of the flight school being willing to invest money, resources, and effort to improve safety (Item 11). While the cost to fix the fuel servo failure was relatively inexpensive, the cost of grounding the fleet for an extended period was significant. The loss of revenue from flight training was compounded by the cost of maintaining the building and staff. This tremendous cost burden shouldered by the flight school was seemingly not lost on the students. Furthermore, placing safety over cost reduction and being proactive about safety, rather than acting in response to safety failures, are enablers of a positive safety culture (ICAO, 2018).

Lastly, students also felt that the flight school did a better job of communicating safety issues raised by pilots to other pilots in the program (Item 8). There were regular communications between administration and students when the fuel servo issue was first discovered and throughout the fleet grounding. Effective communications play an important part in organizations with positive safety culture (ICAO, 2018; Mendonca & Carney, 2017).

There was one survey item that showed a statistically significant difference in the negative direction. Item 12, "The flight school is committed to equipping aircraft with up-to-date technology," changed -0.27 between 2024 (M = 4.63, SD = 0.61) and 2025 (M = 4.36, SD = 0.80). This may be due to a misconception that the fuel servo failure was caused by inadequate technology. Other items on the topic of equipment safety and maintenance were either not statistically significant, or statistically significant in the positive direction. For example, there was no change for Item 13, "The flight school ensures that maintenance on aircraft is adequately performed," or for Item 14, "The flight school ensures that aircraft are safe to operate." A closely related question, Item 11, showed statistically significant difference in the positive direction: "The flight school is willing to invest money, resources, and effort to improve safety."

When comparing the 2025 results of upperclassmen and lowerclassmen, there was only one question that was statistically significant: Item 15, "Students are actively involved in identifying and resolving safety concerns." While it may be expected that all students are operating under the same flight school and the same policies share the same perception of safety

culture, that is not always the case. Adjekum (2014) found variances in students' perception of safety culture among different classification (freshman, sophomore, junior, and senior).

In our study, the upperclassmen had a far more negative view of this item than lowerclassmen. Having been in the program longer, upperclassmen's perception is shaped by their lived experiences, and our results suggest that more experience and time in the program led to a lower view that the program includes students in addressing safety concerns. Perhaps over time they have realized that their safety concerns were not addressed, an experience not shared by lowerclassmen due to insufficient time in the program.

This could have a negative impact on safety culture for three reasons. First, a healthy safety culture invites employee input in addressing safety issues (ICAO, 2018). Second, culture can be changed by the people who lead the organization (Jones & Mathew, 2018), and if lowerclassmen look up to upperclassmen, they could be influenced negatively. And third, subcultures could develop when experiences differ (Daft, 2021). Subcultures are formed when a group of people within an organization form their own culture based on shared similar experiences (Daft, 2021).

While Byrnes et al. (2022) found a decrease in safety culture perception during a prolonged safety crisis (COVID-19), we found that management's safety-oriented actions during a shorter safety crisis boosted the overall safety culture perception of students. Taken together, while the prolonged fleet grounding posed as an inconvenience to many students in terms of flight training progress, our results indicate that they understood it to be a decision made in the best interest of safety.

Limitations

While response rates increased slightly between the two years, the response rates were relatively low. With low response rates, nonresponse bias, which is not always possible to measure, becomes a concern (Bose, 2001). Additionally, this study was conducted at one collegiate flight school covering one full year, which limits the generalizability of the results. Other, smaller safety events experienced by individuals or smaller groups of students may influence the changes in perceptions of safety.

Recommendations for Future Research

There are several recommendations for future studies. First, this survey is sent annually to all students in the spring semester. Some students started the survey but did not complete it. The length of the survey may be a contributing factor. Reducing the length of the survey may increase response rate. Second, there was a negative shift in perception on the technology question between the two years (see Table 2). Future studies into this phenomenon may explain how students view technology as a component of safety. Third, the development of subcultures in the flight school between upper and lowerclassmen should be studied longitudinally to examine safety culture trends among different groups of students.

Conclusion

The safety culture perceptions of the students at a collegiate aviation flight school changed between 2024 and 2025. In between the two years, the flight school experienced a major safety event, where there were multiple reports of engine issues. These issues ultimately led to the voluntary grounding of the entire single-engine fleet. The prolonged fleet grounding posed a great deal of inconvenience and setback for students in flight training. However, the actions taken by management were mostly viewed favorably by students. While many safety culture perception indicators remained unchanged between 2024 and 2025, five out of six items that were statistically significant showed a change in the positive direction. When comparing the safety culture perceptions of lowerclassmen and upperclassmen, most of the safety culture items were similar between the two groups, showing no statistically significant difference. However, the one item that was statistically significant showed that upperclassmen had a more negative view than lowerclassmen.

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