

The Role of Flight Instructors as Catalysts of Safety Management System in Aviation Academies: A Systematic Literature Review

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ABSTRACT

Purpose – The objective of this article is to undertake a comprehensive literature analysis of the strategic importance of flight instructors as implementers of the Safety Management System (SMS) in Approved Training Organisations (ATOs). This review synthesizes the research to understand how instructors transform formal safety principles into everyday operational activities and presents a new conceptual framework of meso-level safety leadership for aviation schools.

Methods – A qualitative topic synthesis was conducted following the PRISMA 2020 procedure. The authors collected metadata of the papers in the Google Scholar database from 2013 to 2025 with the Publish or Perish software. Twelve core peer-reviewed papers were selected for final analysis under tight inclusion and exclusion criteria and quality grading procedures to limit the subjectivity of single-researcher selection.

Findings – Instructors are essential bridges in the meso-layer, transferring explicit SMS rules into everyday actions. These instructors create psychologically safe environments during non-punitive debriefs, fostering an organic safety culture. However, the academic “pressure to fly” and high staff turnover severely limit this catalytic impact. We have developed the ‘Meso-Catalytic Safety Leadership Framework’ to show that generative safety is really the intersection of great meso-leadership and a psychologically secure climate.

Research Implications – The results have practical implications for ATO administrators to restructure Flight Instructor standardization programs with the integration of emotional intelligence and scenario-based safety leadership training. The limitation of the technique is that the current literature is cross-sectional. For future research methodology for an exploratory study, we would recommend longitudinal designs and the ability to apply artificial intelligence reporting systems to offset the loss of institutional memory.

 OPEN ACCESS

ARTICLE HISTORY

Received: 01-07-2026

Revised: 31-07-2026

Accepted: 31-07-2026

KEYWORDS

flight instructor, safety management system, aviation training, safety leadership, just culture

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Introduction

The aviation industry has globally shifted from a reactive stance on events to proactive safety processes, mostly institutionalized through Safety Management Systems (SMS) (Bieder, 2022). Since commercial flight traffic has climbed to 4.5 billion passengers in 2019 and is expected to grow to 8.2 billion in 2037, the potentially catastrophic nature of aviation accidents highlights the importance of proactive safety mitigation (Boeing, 2020). SMS provides an excellent structural basis for protection, but the existence of formal compliance paperwork does not mean operational behavior has changed on the flight line. We need actors who transform rules into practice (A. R. Foster & Adjekum, 2022). Without a robust safety culture, all regulatory standards can be paper exercises. The SMS ecosystem demands that workers participate in the management of dynamic, unanticipated risks, suggesting that management investment alone will not safeguard operations from latent threats without true cultural acceptance (Reason, 1998).

One of the biggest issues for Approved Training Organisations (ATOs) during the ab-initio training period is the latency in real SMS absorption. The operation of passengers is mainly related to commercial airlines, whereas the aviation schools are the most important in defining the professional identity of future aviators (Thomas & Lee, 2016). The adoption of SMS in an academy cannot be a simple hand-down of procedures from the airline; it has to be a basic cultural development approach from the beginning of the program. "This initial part of instruction is really critical. Flight cadets may be mentally fragile, have low operational confidence, and not understand the wider teamwork needed in a safety context (Hong et al., 2016). Academies teach far more than the technical abilities of stick and rudder. They are exactly where a pilot's fundamental perspective, discipline, and safety instincts are permanently plugged in before they ever sit in a commercial cockpit.

A review of the existing literature on aviation safety reveals that the field is situated at two polar ends of the research spectrum: macro research on the organizational structures of commercial airlines and micro research on the human errors of individual pilots (Dekker, 2014). The meso-layer, the major, everyday contacts between flight instructors and cadets, remains neglected, and a significant research deficit exists. This intermediary layer is required for SMS to work. Instructors face a persistent tension between the academic responsibility of teaching safety notions and the significant "pressure to fly" imposed by institutional curriculum objectives (Adjekum et al., 2015; Wahren, 2014). Apart from systemic pressure, the high turnover rate of instructors is a structural pathology jeopardizing institutional memory and the integrity of the safety ecosystem of the ATO (Il, 2023).

The present work offers a way to overcome this structural obstacle by putting flight instructors not just as technical lecturers, but as essential socialization agents and

catalysts that may change static management norms into a live cockpit culture (Cahyo et al., 2025). The instructor is at the forefront, linking top-management norms and field operations through the lenses of Safety Leadership and Organizational Learning. Transformational safety leadership of instructors has been found to promote cadets' intrinsic drive to comply with safety (Adjekum, 2017). Instructors should structure the post-flight debriefings to foster a psychologically safe environment for effective catalytic activity. In such an environment, cadets feel safe to report hazards and understand SMS is a living, breathing document, not a rulebook that stifles them.

The above operational requirements and research gap at the meso-layer level motivate this Systematic Literature Review (SLR) to evaluate the safety management ecosystem of aviation academies holistically. Three different research questions (RQs) are used to guide the study as follows:

1. RQ1: What is the strategic role of flight instructors in activating the Safety Management System ecosystem?
2. RQ2: What are the administrative challenges and institutional barriers to flight instructor effectiveness in the field?
3. RQ3: How is flight instructor safety leadership envisioned through intermediary relationships to develop an organic safety culture?

The results of this broad study are expected to provide a scientific stimulus for the development of the aviation safety literature and a practical model for airline firms to change administrative compliance into a meaningful safety culture.

Methods

The study used a mixed-method research synthesis, Systematic Literature Review (SLR) with a qualitative Thematic Synthesis technique. The methodology allowed for systematic extraction, evaluation, and classification of the literature on human interactions, especially between flight instructors and cadets during the implementation of SMS in higher education in aviation. The processes carefully followed the PRISMA 2020 to guarantee transparency, methodological rigour, and replicability (Page et al., 2021).

The data were primarily collected from the Google Scholar database. Google Scholar was selected due to its coverage of both open access and subscription aviation literature and several geographical regions. Metadata was collected using the Publish or Perish software program. The final search was conducted in mid-2026, and the literature searched was from 2013 through 2025 to provide a current perspective on modern SMS integration. The search method employed a Boolean string of: ("Flight Instructor" OR "CFI") AND ("Safety Management System" OR "SMS") AND ("Safety Culture" OR "Just Culture") AND ("Flight Academy" OR "Collegiate Aviation").

The target population was predominantly limited to peer-reviewed scholarly journal publications solely related to aviation educational ecosystems in ab-initio environments or ATOs. Sampling was based on the application of purposeful criteria to ensure an accurate empirical resolution. Research on commercial airline operations, military aviation, infrastructure, air traffic control (ATC), and unmanned aircraft systems (UAS) was completely disregarded. Dissertations, technical reports, and macroscale conceptual textbooks were not included in the core synthesis but were mostly used as additional background resources to provide the operating framework.

The process of selecting the studies was rigorous and involved deduplication and screening. A Boolean search initially identified 100 potential articles. The initial screening of titles and abstracts excluded 45 papers because of contextual bias towards non-academic aviation. Full texts of the remaining 55 papers were obtained. One article was rejected due to the unavailability of the full text. During the second screening process, 54 full-text papers were evaluated in detail for inclusion. In this phase, 42 studies were reclassified as background literature as they did not specifically focus on instructor-cadet interaction. The technique found twelve main articles. The Critical Appraisal Skills Programme (CASP) checklist was used to assess quality and ensure that the core papers selected for qualitative synthesis had sufficient methodological rigour, limiting the likelihood of single-researcher subjectivity.

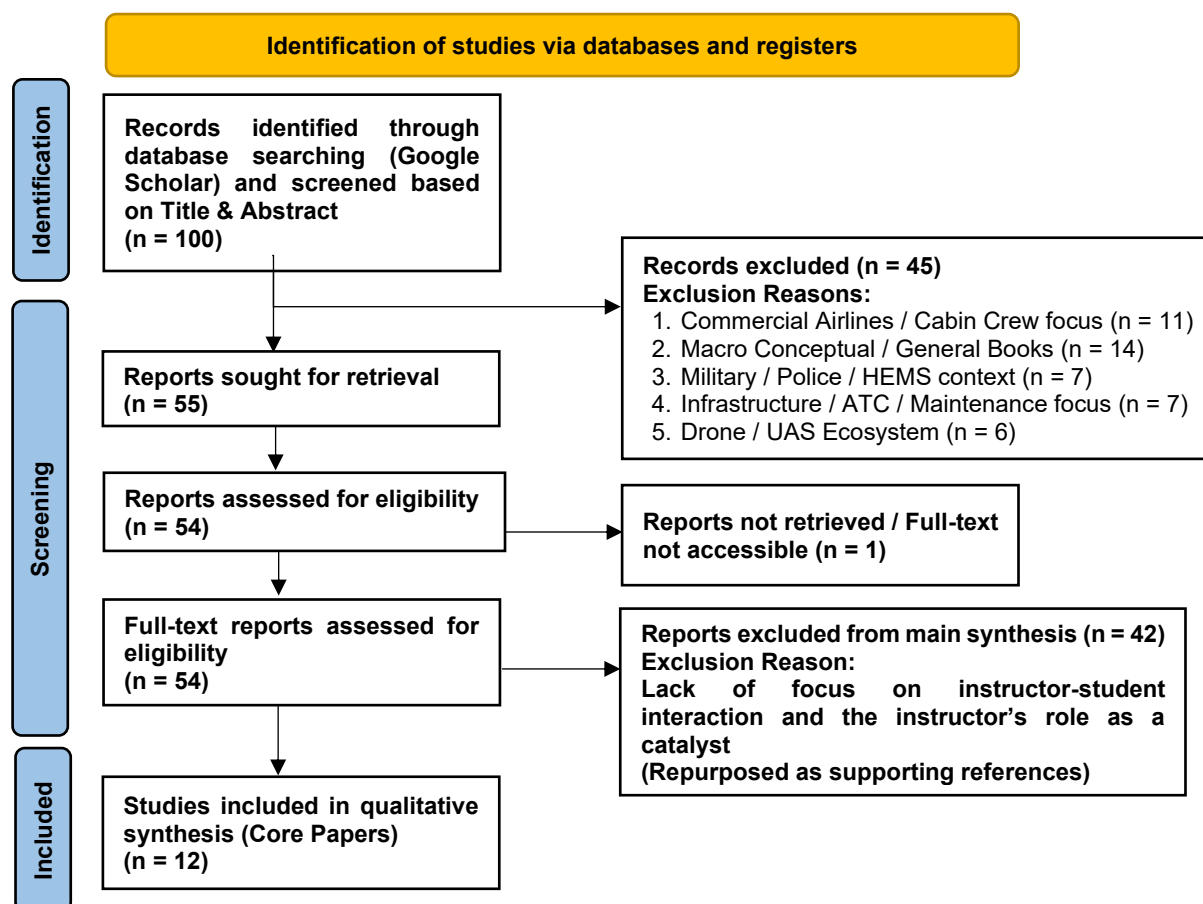


Figure 1. PRISMA 2020 Flow Diagram for the Study Selection Process

During the synthesis phase, the researchers were the main tools for interpreting the data. The twelve selected works were studied in an iterative process to expose the profound contextual implications of the essential functions of the instructor. The data were retrieved and evaluated in a matrix of structures. The textual data were qualitatively evaluated to reveal patterns of psychological and behavioral repetition. Thematic Synthesis was then applied to arrange the detected codes into higher-level themes. The results were confirmed through continuous comparison analysis to ensure they were not subject to interpretation bias and accurately reflected the facts.

Result

Prior to the thematic extraction, a methodological profile of the 12 core articles was performed. The profile revealed that qualitative case studies, cross-sectional surveys, and multivariate analyses have been dominant in the global flight training industry, consisting of ATOs in the USA, Australia, and state aviation institutions in Indonesia (e.g., Akademi Penerbang Indonesia Banyuwangi). The quality appraisal revealed that the observational reporting was highly credible and that the theoretical framework used to examine the application of SMS was robust. Table 1 presents the basic research that is covered in this synthesis.

Table 1. Summary of key studies included in the synthesis

No	Author & Year	Context & Location	Method & Sample	Main Findings & Synthesis Contribution
1	Adjekum (2014)	USA (Collegiate ATO)	Quantitative (Survey)	Identified demographic disparities; international cadets perceive lower safety commitment.
2	Adjekum et al. (2015).	USA (Collegiate ATO)	Mixed Methods	Revealed the "pressure to fly" among instructors and cadets, hindering reporting behaviors.
3	Adjekum et al. (2016).	USA (Collegiate ATO)	Quantitative (Survey)	Highlighted that older cadets show declining trends in safety reporting frequency.
4	Cahyo et al. (2025).	Indonesia (API)	Qualitative (SLR)	Instructors act as cultural transmitters; psychological safety in debriefs is crucial.
5	Foster & Adjekum (2022)	USA (Multiple ATOs)	Qualitative (Interviews)	Instructors have more daily influence than safety directors; feedback loops are vital.
6	Foster & Adjekum (2023)	USA (Collegiate ATO)	Quantitative (SEM)	Instructor "buy-in" is a strong predictor of proactive safety compliance and participation.
7	Freiwald et al. (2013).	USA (FTO)	Qualitative (Case Study)	High turnover rates severely disrupt SMS implementation and institutional memory.
8	Gao & Rajendran (2017)	Australia (Tertiary ATO)	Quantitative (Survey)	Safety perceptions and reporting enthusiasm decline as cadets progress in their training.
9	Robertson (2017)	USA (13 ATOs)	Quantitative (Survey)	Management commitment and resource allocation directly impact safety culture strength.

No	Author & Year	Context & Location	Method & Sample	Main Findings & Synthesis Contribution
10	Sharma (2023)	USA (Flight Schools)	Quantitative (Regression)	Instructor Conscientiousness and self-efficacy are primary drivers of safety behavior.
11	Silcox et al. (2023).	USA (University ATO)	Qualitative (Case Study)	Two-way communication and safety standdowns effectively mitigate external airspace risks.
12	Wicaksono et al. (2025)	Indonesia (API)	Qualitative (Q-Method)	Just culture emerges organically when organizations remove blind punishment threats.

1. Flight Instructors as Meso Actors and 'Safety Leaders' in the SMS Ecosystem

Continuous data synthesis confirms the view of flight instructors, especially Certified Flight Instructors (CFIs), as the central actors at the organizational meso-level. Instructors are a vital bridge in the academy's SMS environment, translating strict formal safety regulations into cognitive practices and practical actions (Cahyo et al., 2025; A. R. Foster & Adjekum, 2022). Regarding Safety Leadership, flight instructors are not only technical skills teachers, but also powerful behavioral role models and cultural carriers, who physically affect cadets' risk perceptions (Cahyo et al., 2025). Instructors have a direct and daily impact since they are the closest authority figures to translate theoretical safety principles into practical operational judgments in real flying scenarios (A. R. Foster & Adjekum, 2022).

The success or failure of frontline SMS operationalisation hinges on the level of instructor engagement in the decision-making process. When teachers actively participate, a social exchange system is created in the school. Management's safety policies are converted into shared behavioral norms rather than bureaucratic nagging (R. A. Foster & Adjekum, 2023). Even when a guideline urges them to, teachers do not automatically display great safety behavior. Their behavior is greatly affected by the interaction between the organizational safety climate in the top management and the individual personality of the instructor. More specifically, the Conscientiousness dimension, mediated by self-efficacy, is the most important psychological predictor of an instructor taking consistent safety steps (Sharma, 2023).

2. Risk Communication and Role Modelling for Developing Safety Culture

If an aviation academy wishes to establish an organic safety culture, it needs risk communication channels that are strongly based on Organisational Learning. It involves providing a psychologically safe environment. The evidence indicates that safety culture is seeded and cultivated by instructors continuously engaging in deep reflective discourse during post-flight debriefings. Cadets can communicate about their operational blunders without being intimidated or condemned for these discussions. This makes errors beneficial learning moments instead of punishing offences (Cahyo et al., 2025). This form of empathic debriefing accelerates the internalisation of safety values. This is consistent with the success of Just Culture implementation in areas like API Banyuwangi. It indicates

that cultural justice will automatically emerge when an institution is dedicated to removing blind punishment, underpinned by a common belief that humans are naturally prone to mistakes (Wicaksono et al., 2025).

It is not just the micro-level talks in the cockpit that matter, but also macro-mechanisms. Circular, two-way communication from top management to instructors is important for the system to be durable. Moreover, as an organization faces a complicated operational problem, like airspace congestion, we look to instructors as the primary strategic target to update SOPs. Participatory forums such as safety standdowns create a positive feedback loop to improve the system over time (Silcox et al., 2023). High institutional response and rapid comment on each danger report filed by frontline staff have been demonstrated to develop deep ownership and encourage organic, active involvement from both instructors and cadets (A. R. Foster & Adjekum, 2022).

3. Implementation Problems and Managerial Factors in Aviation Academies

The literature reviews a large number of managerial, psychological, and organisational barriers that significantly limit the efficiency of teachers as catalysts for SMS, although they are strategically significant. The “pressure to fly” is the most significant challenge from an operational standpoint. This commercial and academic pressure spurs people to achieve ground curriculum flight hour targets. It places people, especially senior CFIs, in very difficult positions. They often compromise proactive safety reporting to guarantee smooth operations of the flight production schedule (Adjekum et al., 2015). Demographic issues and various psychosocial barriers further impede cultural standardisation. Older cadets tend to report safety less often (Adjekum, 2016), and foreign cadets tend to have perceptual distortions and rate leadership safety commitment lower than domestic cadets (Adjekum, 2014).

Further, there is evidence that increasing their knowledge is connected with a decrease in positive attitudes towards safety reporting (Gao & Rajendran, 2017). High turnover of instructional staff diminishes institutional memory and hinders the development of safety culture in the long term, impacting ATO operational stability on a systemic level (R. A. Foster & Adjekum, 2023; Freiwald et al., 2013). This organisational disease is further exacerbated by incidents of practical drift, i.e., incremental deviations from operational procedures established in everyday practice, and resource limitation that limits formal SMS implementation to paper compliance (Robertson, 2017; Wicaksono et al., 2025).

Discussion

Some of the key conceptions identified in the synthesis need to be defined before the conceptual framework can be extended. Sensed ownership is a psychological state in which frontline workers feel responsible for the safety performance of the business. Just culture is a climate of trust in which people feel encouraged to share safety-critical

information for fear of retaliation for honest mistakes. Practical drift is the slow change of actual field practice away from the specified protocols, as a consequence of local modifications over time.

1. The Catalyst Effect: Transforming Formal SMS into Organic

Safety Culture. The literature suggests that top-down bureaucratic dictates cannot command the transition from calculative/compliance safety to generative/organic safety. To successfully change culture, you have to have active meso-level action. Flight instructors act as intermediates to minimize institutional decoupling by bridging the gap between formal safety requirements and evolving real-world operations. Instructors are operational interpreters, interpreting the regulations and applying them to cadets in real context (Cahyo et al., 2025; A. R. Foster & Adjekum, 2022).

From an Organizational Learning perspective, the contact between instructors and cadets in the cockpit and debriefing rooms modifies the essential character of the SMS. It changes the paradigm from a reactive system to a proactive and meditative system. Instructors encourage cadets to see safety as an internalized behavior and not an external limitation, creating psychologically secure situations. However, safety systems are internal guides to a cognitive compass in decision-making in operation. As the organization matures farther along the safety culture continuum, to the generative stage, threat detection becomes part of the pilot's professional identity (Dekker, 2014).

2. Instructor as a Safety Leader Conceptual Framework

The Meso-Catalytic Safety Leadership Framework in Aviation Training is a novel conceptual paradigm that was developed through an extensive synthesis of the extracted data. This paradigm views the flight instructor as the change agent in corporate safety through three dynamic, interactive dimensions. This model was directly derived from the synthesized themes, marking a departure from previous macro-level SMS models by identifying the meso-level teacher as the vital catalyst.

Table 2. Meso-Catalytic Safety Aviation Training Leadership Framework

Framework Dimension	Main Components & Theoretical Foundation	Output Mechanisms
1. Core Antecedents (Input)	Organizational Safety Climate and Instructor Personality Profile (Conscientiousness) (Sharma, 2023)	Increased Self-Efficacy and Intrinsic Instructor Motivation
2. Meso-Intermediary Process	Non-Punitive Reflective Dialogue in De-briefing, Scenario-Based Learning, and Prompt Feedback (Cahyo et al., 2025; A. R. Foster & Adjekum, 2022)	Construction of a Psychologically Safe Space
3. Organic Outcomes	Proactive Social Exchange, Sensed Ownership, and Just Culture (R. A. Foster & Adjekum, 2023; Wicaksono et al., 2025).	Organic Generative Compliance & Elimination of Practical Drift.

This conceptual framework theorizes that the effectiveness of SMS in the final stage (Organic Outcomes) is multiplicatively modulated by the effectiveness of the interactions during the meso-intermediary process. Conceptually, a strong organic safety culture is dependent on the synergistic interaction of meso-leadership commitment and the quality of the safe psychological climate, while being negatively impacted by operational pressures and personnel turnover.

This theoretical proposition highlights that safety leadership interventions by meso-layer instructors are a significant force multiplier. If the meso-leadership value is eroded by either instructor apathy or an exclusive focus on technical competencies, the organizational safety climate designed by top management will not spontaneously unfold at the cadet level, eventually eroding under the weight of academic pressures. As a conceptual framework, this framework is open to future empirical validation.

3. Research Implications for Approved Training Organizations (ATOs)

The implications of the findings of this systematic study for the Approved Training Organization (ATO) administrators are practical. The literature suggests a possible benefit in shifting the focus of strategic investment by ATO management to strengthen the leadership capacity of teachers at the meso-layer. The formal instructor development framework could be modified to include emotional intelligence training and seminars on empathy-based leadership for instructors with good risk communication skills (Cahyo et al., 2025).

Research suggests that scenario-based learning strategies may be more effective than typical doctrinal SMS lectures in an educational setting. Cadets who participate in simulations that require complex safety decision-making integrate safety values to a greater extent (A. R. Foster & Adjekum, 2022). The findings also suggest that the institutional process for recruiting instructors could be improved by including validated psychometric tests to ensure that candidates have the appropriate level of conscientiousness to be effective safety leaders (Sharma, 2023).

Conclusion

The findings of this study, based on an extensive literature study, indicate that Safety Management Systems (SMS) in aviation education are much more than a formality to meet administrative requirements. The transformation from rule-based compliance to an organic safety culture is critically dependent on the catalytic mediating role of flight instructors in the meso-layer. The study synthesizes evidence to suggest the “Meso-Catalytic Safety Leadership Framework,” showing how a generative safety culture emerges from the interaction between instructor personality profiles and organizational climate, as evidenced by the creation of psychologically safe spaces during non-punitive debriefings. Without this meso-level leadership, formal SMS policies are prone to surface formality when the burden of operational limits and human attrition begins to weigh.

The findings here suggest a practical need for Approved Training Organizations (ATOs) to expand the scope of their flight instructor standardization programs from merely testing technical proficiency to the development of robust safety leadership abilities. There are evidence-based techniques to strengthen the safety ecosystem: emotional intelligence training, scenario-based safety learning, and proactive psychometric screening. Effective operational feedback loops will also be critical to mitigate practical drift on the flight line.

Some methodological limitations of the present investigation: The synthesis of this study is limited to a sample of 12 key studies due to the parameters employed to search the Google Scholar database. Also, the current literature is abundant with cross-sectional studies, which restrict the establishment of long-term causal relationships about the construction of safety culture. Future studies could consider longitudinal designs to evaluate the persistence of a cadet's safety culture from the ab-initio phase until transition to commercial aircraft. Additionally, future studies are encouraged to explore the use of predictive artificial intelligence (AI) in safety reporting systems. This would be an interesting thread on how to solve the problem of loss of institutional memory caused by high flight instructor attrition.

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