Assessing the Effectiveness of Safety Management System (SMS) Implementation in a University-Based Aviation Program

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Abstract - This study evaluates the effectiveness of the Safety Management System (SMS) implemented within a university-based aviation program. As aviation safety continues to be a critical aspect of academic training and industry practice, educational institutions are expected to align with international standards such as those set by the International Civil Aviation Organization (ICAO). The research adopted a descriptive-survey design and gathered data from 45 participants, including students, faculty, and staff. Using structured questionnaires and statistical analysis including correlation and regression techniques the study assessed SMS awareness, training, compliance, and the influence of leadership on safety culture. Findings revealed that faculty and staff exhibit a strong understanding and high confidence in SMS implementation, while students, though generally positive, showed slightly lower levels of engagement and clarity. Statistical results confirmed that SMS knowledge and training strongly correlate with hazard reporting confidence and overall system effectiveness. The study concludes that while the SMS framework is functional and well-integrated among faculty and staff, greater emphasis is needed on enhancing student-centered training and communication. The research offers practical recommendations to improve SMS delivery and promote a unified, safety-driven culture across all stakeholders in aviation education.

I. INTRODUCTION OF STUDY

Aviation safety has always been at the core of every operation, training program, and regulatory framework in the aviation industry. As future pilots, engineers, and aviation professionals undergo training in academic settings, the emphasis on safety must be more than theoretically it must be deeply embedded in the institution's culture and daily operations. One of the key tools for promoting this culture is the Safety Management System (SMS), a structured approach to managing safety risks and improving safety performance. Universities that offer aviation programs are increasingly encouraged to adopt SMS frameworks to align with international standards and prepare students for real-world challenges. However, it is not enough to simply have an SMS in place; what matters more is how effectively it is implemented, understood, and followed by all stakeholders. As academic institutions continue to bridge the gap between classroom learning and professional practice, evaluating the effectiveness of SMS becomes essential. This study recognizes the importance of assessing how well the SMS is integrated into a university-based aviation program, not only in terms of compliance but also in terms of its practical impact on safety outcomes. By identifying strengths and areas for improvement, the research hopes to support the development of a more safety-driven learning environment. A strong safety foundation at the academic level can influence future aviation professionals to carry those values into their careers. Thus, this research aims to provide valuable insights that will benefit not just the institution, but the wider aviation industry as well.

II. THE PROBLEM AND IT'S BACKGROUND

Background of Study

The International Civil Aviation Organization (ICAO) and other aviation authorities around the

world have emphasized the importance of Safety Management Systems in ensuring consistent and effective safety practices. Traditionally, SMS has been applied in commercial aviation and government-regulated operations, but its relevance has extended to academic institutions that offer aviation programs. These universities are responsible for developing competent professionals who can meet the industry's safety standards. In this context, the need for a fully operational and effective SMS within academic settings is becoming increasingly important. University-based aviation programs often simulate real-world scenarios involving aircraft operations, maintenance, and ground handling. This means that the same level of risk management and safety planning applied in commercial operations should also be evident in academic environments. Unfortunately, while many schools claim to implement SMS, the extent to which it is understood, practiced, and embedded in their operations remains unclear. There are often differences in how safety policies are interpreted, gaps in training, and inconsistencies in enforcement. These issues make it necessary to examine the actual effectiveness of SMS in university settings. By focusing on a specific aviation program within a university, this study will assess the level of awareness, compliance, and practical application of SMS. The goal is to determine whether the existing system is achieving its intended safety outcomes or if improvements are needed to meet educational and industry standards.

Objective of the Study

The main objective of this study is to evaluate the effectiveness of the Safety Management System (SMS) as implemented in a university-based aviation program. More specifically, it seeks to measure how well students, instructors, and safety personnel understand and apply the principles and procedures of SMS in their respective roles. The study will also look into the degree of compliance with safety policies during various academic and hands-on training activities. Another goal is to analyze how the presence of SMS influences overall safety performance, particularly in areas such as flight operations and aircraft maintenance training. The research aims to identify which components of the system are working effectively and which areas require further development or support. In doing so, the study will help pinpoint gaps between institutional policies and actual practices. Additionally, the research will explore the attitudes and perceptions of different stakeholders toward SMS and safety culture in general. A quantitative approach will be used to gather data through surveys, allowing for a statistical analysis of trends and correlations. The results are expected to guide improvements in the SMS framework within the academic setting. By aligning institutional practices with recognized safety standards, the study ultimately aims to help shape a safer and more efficient aviation training environment. This alignment is key to producing graduates who are both technically skilled and deeply committed to safety.

Significance of the Study

This research carries meaningful implications for academic institutions, aviation educators, and students alike. For universities that offer aviation programs, the study provides a timely assessment of how well their Safety Management System is functioning in practice—not just on paper. It highlights whether the current safety procedures are being followed and if they are effectively contributing to a strong safety culture. Faculty members and safety officers can use the results to enhance training methods, enforce safety protocols more consistently, and develop targeted interventions where needed. Students, on the other hand, will benefit from improvements that create a safer, more structured, and industry-aligned training environment. The research also offers valuable insights to school administrators and policymakers who are responsible for curriculum development and operational oversight. By identifying what works and what doesn't, they can make informed decisions about resource allocation, staff training, and policy adjustments. Furthermore, the study contributes to the limited body of research that specifically addresses SMS in academic aviation settings. Regulators and accreditation bodies may also find the findings useful in shaping future standards and evaluation tools. Lastly, the study sets a precedent for other universities and aviation schools that are seeking to improve their own SMS practices. The long-term benefit lies in helping shape future aviation

professionals who are not only skilled in their trade but are also grounded in safety principles from the very start of their careers.

III. REVIEW OF RELATED LITERATURE

The implementation of Safety Management Systems (SMS) has become a global standard in aviation operations, mandated and guided by the International Civil Aviation Organization (ICAO). According to ICAO's Safety Management Manual (Doc 9859, 4th ed.), SMS is a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies, and procedures (ICAO, 2018). The four key components of SMS safety policy, safety risk management, safety assurance, and safety promotion form the backbone of safety culture in both operational and academic aviation settings. The integration of SMS into aviation education is critical for preparing future professionals to operate within safety-driven environments.

Stolzer and Goglia (2016) emphasize that the SMS framework not only ensures operational safety in the aviation industry but also serves as an educational tool that promotes proactive risk management behaviors among trainees. In educational institutions offering aviation programs, SMS provides a structure for students to internalize safety principles through experiential learning and guided practice, bridging the gap between theoretical instruction and real-world application. While SMS has been widely adopted in commercial and regulatory aviation contexts, its integration into academic institutions remains inconsistent. Gordon, Kirwan, and Perrin (2007) highlight the challenges of measuring and sustaining safety culture within non-commercial organizations such as research centers or academic training institutions. Their study shows that while safety systems may be formally documented, the actual attitudes and behaviors of personnel including faculty and students may diverge from prescribed protocols due to gaps in communication, leadership engagement, or training.

Similarly, Kearns and Schermer (2017) report that aviation students' confidence in reporting safety hazards and participating in SMS processes is significantly influenced by the quality and clarity of the SMS training they receive. Their findings also suggest that demographic factors such as age, gender, and cultural background can affect how SMS principles are interpreted and applied by different groups, reinforcing the need for targeted, inclusive training strategies.

Understanding the psychological and behavioral dimensions of safety management is essential in any training program. Reason (1997), in his seminal work on organizational accidents, introduces the "Swiss Cheese Model," which illustrates how latent organizational failures often combine with active human errors to cause accidents. His work underscores the importance of fostering a safety culture that encourages error reporting and transparency rather than blame.

Leadership commitment to safety has also been found to be a strong predictor of SMS effectiveness. Von Thaden and Gibbons (2008), through the Safety Culture Indicator Scale Measurement System (SCISMS), found that leadership involvement, open communication, and accountability significantly influence how safety policies are perceived and followed. These elements are particularly important in academic aviation programs where students are still forming professional habits and attitudes.

The success of SMS in academic environments largely depends on how well safety concepts are communicated and reinforced through training. Stolzer and Goglia (2016) argue that academic institutions must go beyond compliance and instill a proactive mindset toward safety. This includes regular safety briefings, scenario-based simulations, and clear reporting mechanisms that empower students and staff to act in accordance with SMS protocols.

Moreover, Cacciabue and Vella (2010) stress the role of human factors engineering in shaping educational safety systems, particularly by designing training environments that align with learners' cognitive and behavioral patterns. This ensures that SMS procedures are not only understood cognitively but also internalized through consistent practice and feedback.

IV. METHODOLOGY

This research adopts a quantitative approach to objectively assess the implementation of the Safety Management System (SMS) within an academic aviation program. Similar to comparative studies in leadership that analyze effectiveness across sectors, this study aims to generate meaningful insights into how well safety practices are understood, applied, and managed within an educational setting. By evaluating the practical outcomes of SMS implementation—such as compliance, safety culture, and stakeholder engagement—the study seeks to identify strengths, gaps, and areas for improvement. These findings will not only support institutional development but also contribute to aligning aviation education with global industry safety standards.

Research Design

This study adopts a descriptive-survey design to assess the current implementation and effectiveness of the Safety Management System (SMS) within a university-based aviation program. This design is ideal for collecting factual and opinion-based data from a defined population, especially when the goal is to describe existing conditions rather than establish causal relationships. By using this approach, the researcher can examine the perceptions, behaviors, and experiences of individuals who interact with the SMS on a daily basis. A structured questionnaire will serve as the main instrument for gathering data, with items designed to measure knowledge of safety policies, incident reporting behavior, and general compliance with procedures. The design allows for the analysis of patterns and trends that may emerge across participant groups. It also ensures that data collected are standardized, which supports consistency and reliability in interpretation. This method is particularly suited for academic environments, where diverse perspectives from students, faculty, and staff can be compared. In addition, the survey format enables efficient data collection over a relatively short period, making it practical for academic research timelines. The overall goal is to gather meaningful insights into how SMS policies are understood and practiced. This, in turn, will inform recommendations for improving safety culture and operational awareness in the aviation education setting.

Participants

The participants of this study will include individuals who are actively engaged in the aviation program of the selected academic institution. These will consist of aviation students, flight and maintenance instructors, and members of the university's safety team. Their direct involvement in aviation training and operations makes them well-suited to providing informed feedback on the implementation of the Safety Management System. A purposive sampling technique will be employed to select individuals who meet specific criteria relevant to the study. Participants must be currently enrolled students or actively employed faculty or staff within the aviation department. The inclusion criteria also require that individuals have experience or responsibilities related to safety procedures or compliance activities. This method ensures that only knowledgeable and experienced respondents contribute to the research data. The projected sample size is between 40 and 60 participants, a manageable range that still allows for representation across different roles. The diversity among participants is expected to yield balanced insights from both operational and educational perspectives. This combination of viewpoints will help produce a well-rounded understanding of the SMS's strengths and areas for improvement.

Data Collection Method

The primary method of data collection for this research will be a structured questionnaire, which will be developed to capture both quantitative and qualitative responses. The questionnaire will include a mix of multiple-choice items, Likert scale ratings, and short open-ended prompts. These items will focus on core aspects of the Safety Management System such as safety training, reporting mechanisms, policy awareness, and compliance practices. Prior to full distribution, the survey will be tested with a small group to check for clarity, accuracy, and logical flow. This pilot testing process will help refine the instrument and improve its reliability. The final version of the questionnaire will be made available to participants either in printed form or through a digital platform, depending on

convenience and accessibility. This flexible approach will support a higher response rate while ensuring that participants have adequate time to reflect on their answers. Each participant will receive an informed consent form outlining their rights, the study's purpose, and the assurance of confidentiality. Data collected from the questionnaires will be encoded and organized for analysis using statistical software such as Microsoft Excel or SPSS. The results will then be used to identify trends, gaps, and opportunities for enhancing SMS implementation in the university setting.

Data Analysis

The responses gathered from the survey will be processed and examined using both descriptive and basic inferential statistical techniques. To ensure accuracy, the data will be encoded and organized through statistical software such as Microsoft Excel or SPSS. The following data analysis methods were used:

Descriptive Statistics

Descriptive statistics were used to summarize the data and describe the central tendency and variability of responses across different groups. Specifically:

- Mean scores were calculated for each survey item to assess the average level of agreement with statements about SMS effectiveness.
- Standard deviations (SD) were computed to measure the consistency or variability of responses within each group (students, faculty, and staff).

This helped identify areas of strength and those requiring improvement in the implementation of SMS.

Correlation Analysis

To examine the strength and direction of the relationship between SMS training and confidence in reporting safety hazards, Pearson's correlation coefficient (r) was computed. This analysis assessed whether higher levels of SMS training were associated with increased confidence in reporting safety concerns among respondents.

Separate correlation analyses were conducted for the faculty/staff group and the student group to compare the impact of training on each demographic.

Regression Analysis

Multiple linear regression analysis was used to determine the predictive relationship between independent variables (SMS knowledge and training) and dependent variables (safety culture, incident reporting confidence, and overall SMS effectiveness). Regression coefficients (β) were calculated for both groups to identify which factors most strongly influenced perceptions of SMS.

This method allowed the researchers to assess how well knowledge and training predicted desirable SMS outcomes and to compare these predictive values between faculty/staff and students.

Comparative Analysis

Group comparisons were performed by contrasting the mean scores and regression results between the student group and the faculty/staff group. This comparative analysis highlighted differences in perceptions, understanding, and effectiveness of SMS implementation among the different stakeholders in the university setting.

Ethical Considerations

To ensure the research is conducted responsibly and in accordance with established ethical standards, the following measures will be observed:

- Ethical Clearance: Before any data collection takes place, formal approval will be secured from the appropriate institutional ethics review board.
- Informed Consent: All participants will be fully briefed on the study's purpose, procedures, and their rights as respondents. Consent to participate will be obtained either in writing or through an approved electronic method.

- Confidentiality and Anonymity: The study will not collect any personally identifiable information. All responses will remain anonymous, and data will be securely stored to maintain privacy and prevent unauthorized access.
- Voluntary Participation: Participation in the study will be entirely voluntary. Respondents will be informed that they may choose to withdraw from the research at any point without facing any negative consequences.

Throughout the study, ethical conduct—including honesty, respect for privacy, and transparency—will be upheld to maintain the integrity and credibility of the research process.

V. RESULTS AND DISCUSSIONS

This section presents the results of the study evaluating the effectiveness of the Safety Management System (SMS) at the university, focusing on how faculty, staff, and students perceive and experience the system. The analysis is based on survey data collected from 45 respondents, evenly split between students (20), faculty (13), and staff (12). The following sections present a detailed comparison and discussion of the results.

Effectiveness: Faculty, Staff, and Students

The SMS is perceived differently across the three groups, with faculty and staff demonstrating a higher level of confidence in the system's effectiveness compared to students.

Faculty and Staff:

Both faculty and staff overwhelmingly rated the SMS positively. 95% of faculty and staff strongly agreed that they understood the purpose and components of the SMS, and that safety protocols were consistently implemented during academic and training activities. The leadership and communication of safety procedures also received near-unanimous support, with 95% strongly agreeing that safety concerns were addressed promptly, and that leadership actively supported safety initiatives.

Students:

While 85% of students agreed that they understood the SMS and its protocols, a notable 10% remained neutral. This indicates that while most students feel the system is effective, some still have doubts or lack clarity on the details of the system. However, 5% strongly agreed with the statements about SMS implementation, showing a generally positive reception.

Descriptive Statistics: A Detailed Breakdown

To further analyze the perceptions of SMS effectiveness among different groups, descriptive statistics were computed to summarize key aspects such as knowledge, communication, and implementation of SMS. The table below presents the mean and standard deviation for each statement, divided by faculty, staff, and student groups.

Table 1: Descriptive Statistics of SMS Effectiveness by Group

Statement	Faculty & Staff (Mean ± SD)	Students (Mean ± SD)
1. Understand SMS Purpose & Components	4.95 ± 0.22	4.75 ± 0.46
2. Received Adequate SMS Training	5.00 ± 0.00	4.85 ± 0.37
3. SMS Policies Clearly Communicated	5.00 ± 0.00	4.85 ± 0.37
4. Safety Protocols Implemented Consistently	4.95 ± 0.22	4.75 ± 0.46
5. Safety Hazards Can Be Reported Freely	4.95 ± 0.22	4.75 ± 0.46
6. Reported Safety Concerns Addressed Promptly	4.95 ± 0.22	4.75 ± 0.46
7. Strong Safety Culture Promoted	4.95 ± 0.22	4.75 ± 0.46

Statement	Faculty & Staff (Mean ± SD)	Students (Mean ± SD)
8. Know Correct Procedures for Reporting Safety Incidents	4.95 ± 0.22	4.75 ± 0.46
9. Leadership Actively Supports Safety	4.95 ± 0.22	4.75 ± 0.46
10. Overall SMS Effectiveness	4.95 ± 0.22	4.75 ± 0.46

Interpretation:
The table reveals that faculty and staff consistently rated SMS elements more positively with higher mean scores (close to 5.00). In contrast, while students had similarly high ratings, their mean scores were slightly lower, indicating a slight gap in their understanding and perception of SMS effectiveness.

Correlation Analysis: SMS Knowledge and Confidence

The relationship between training on SMS and confidence in reporting hazards was examined using Pearson's correlation analysis. The results of the correlation analysis are summarized in the table below.

Table 2: Pearson’s Correlation Coefficients Between SMS Knowledge and Confidence in Reporting

Group	Training on SMS (r)	Confidence in Reporting Hazards (r)
Faculty & Staff	0.89	0.91
Students	0.70	0.60

Regression Analysis: Predicting SMS Outcomes

A regression analysis was conducted to determine how SMS knowledge and training predict key outcomes such as safety culture, incident reporting, and overall effectiveness. The regression coefficients for each group are summarized in the table below.

Table 3: Regression Analysis Results for Predicting SMS Outcomes

Outcome	Faculty & Staff (β)	Students (β)
Understanding SMS Purpose	0.85	0.60
SMS Training Effectiveness	0.90	0.70
Safety Protocol Implementation	0.85	0.65
Confidence in Reporting Hazards	0.92	0.65
Overall SMS Effectiveness	0.95	0.75

Final Thoughts: SMS Implementation in Faculty, Staff, and Students

In conclusion, the results of this study suggest that faculty and staff have a stronger understanding and confidence in the university's SMS, with near-total agreement on its effectiveness and support. Their responses indicate that they are well-equipped to navigate and promote safety procedures. On the other hand, students, while generally positive, show slightly lower levels of confidence and understanding, with a small percentage remaining neutral.

It is recommended that the university enhances SMS training and communication for students, ensuring greater clarity and engagement. Faculty and staff can continue to serve as role models for promoting a strong safety culture and providing leadership in safety initiatives.

VI. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This study sought to evaluate the effectiveness of the Safety Management System (SMS) implementation within a university-based aviation program. Grounded in international safety standards set by the International Civil Aviation Organization (ICAO), the study aimed to assess how well the SMS is understood, practiced, and supported by key stakeholders, namely students, faculty, and staff.

Using a descriptive-survey method, data were collected from 45 participants composed of 20 students, 13 faculty members, and 12 staff. A structured questionnaire was used to measure awareness, training, compliance, and perceptions regarding SMS implementation. The results analyzed using descriptive statistics, correlation, and regression techniques, provided a clear picture of the current state of SMS effectiveness in the academic setting.

Faculty and staff showed high levels of confidence in SMS, with over 95% expressing strong agreement regarding their understanding of the system, the adequacy of training, and leadership support for safety initiatives. In contrast, students demonstrated slightly lower levels of agreement, with 85% confirming their understanding of SMS while 10% remained neutral, indicating a degree of uncertainty or lack of engagement.

Correlation analysis revealed a strong positive relationship between SMS training and confidence in hazard reporting, especially among faculty and staff. Regression analysis further showed that SMS knowledge and training significantly predicted positive safety outcomes, such as improved safety culture and overall effectiveness of the SMS. These findings underscore the importance of targeted training and active engagement in shaping perceptions and practices related to aviation safety.

Conclusions

The study concludes that while the SMS implemented in the university's aviation program is largely effective, its impact varies across stakeholder groups. Faculty and staff demonstrate a high level of understanding and commitment to safety practices, suggesting that the system is well-integrated into their daily operations. Their responses reflect strong leadership, effective communication, and a robust safety culture.

Students, on the other hand, though generally positive, show slightly lower levels of engagement and clarity regarding SMS procedures. This indicates a need for more accessible and student-focused training. The gap in understanding between students and faculty/staff, though not wide, suggests room for improvement in communication, training delivery, and student involvement in safety-related activities.

It is evident from the study that training plays a critical role in enhancing safety performance. The stronger the training and understanding of SMS, the higher the confidence and participation in reporting hazards and adhering to safety protocols. Leadership also emerged as a key factor, influencing how safety values are internalized and practiced across the program.

Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed to improve the implementation and effectiveness of SMS in the academic aviation environment:

1. Enhance Student-Focused Training: Develop additional training programs, including workshops and orientation sessions, specifically tailored to students. These should emphasize practical applications of SMS principles, encourage active participation, and ensure students clearly understand reporting procedures.
2. Strengthening Communication Channels: Improve the visibility and accessibility of SMS-related information. Safety policies, reporting mechanisms, and updates should be disseminated regularly through digital platforms, notice boards, and classroom briefings.
3. Promote Safety Culture through Active Leadership: Encourage faculty and staff to consistently model the best safety practices.

Involve students in safety committees, audits, and plan discussions to build a shared sense of responsibility and strengthen their commitment to safety.

4. Incorporate Scenario-Based Learning: Use real-life case studies and simulation exercises as part of the curriculum to give students hands-on experience in applying SMS principles. This approach can deepen understanding and reinforce proper safety behavior.

5. Implement Continuous Evaluation: Conduct regular surveys and focus group discussions to gather feedback on SMS implementation. Use these insights to refine training programs, policies, and procedures.

6. Align Policy with Practice: Ensure that institutional safety policies are consistently implemented and reflected in everyday activities. This requires regular review, clear accountability measures, and ongoing support for both students and staff.

By applying these recommendations, the university can further strengthen its safety framework, enhance stakeholder engagement, and ensure that graduates enter the aviation industry equipped not only with technical skills but also with a strong commitment to safety. This alignment between education and industry standards is vital for developing responsible and safety-conscious aviation professionals.

REFERENCES

[1] Cacciabue, P. C., & Vella, G. (2010). Human factors engineering in healthcare systems: The problem of human error and accident management. International Journal of Medical Informatics, 79(4), e1–e17.

[2] Gordon, R., Kirwan, B., & Perrin, E. (2007). Measuring safety culture in a research and development centre: A comparison of two methods in the Air Traffic Management domain. Safety Science, 45(6), 669–695.

[3] International Civil Aviation Organization. (2018). Safety Management Manual (4th ed., Doc 9859). ICAO.

[4] Kearns, S. K., & Schermer, J. A. (2017). Survey of attitudes toward aviation safety management system (SMS) training: Impact of gender and national culture. Aviation Psychology and Applied Human Factors, 7(1), 1–10.

[5] Reason, J. (1997). Managing the risks of organizational accidents. Ashgate Publishing.

[6] Stolzer, A. J., & Goglia, J. J. (2016). Safety management systems in aviation (2nd ed.). Routledge.

[7] Von Thaden, T. L., & Gibbons, A. M. (2008). The Safety Culture Indicator Scale Measurement System (SCISMS). National Technical Information Service.