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Impact of Academic Competence on Air Traffic Safety Improvement at AirNav Indonesia JATSC Branch

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Abstract

Aviation safety is a critical aspect of air traffic services, particularly in operational units with high traffic density and complexity such as the Jakarta Air Traffic Service Center (JATSC). The continuous growth of air traffic volume requires Air Traffic Controllers (ATC) to possess strong academic competence to support accurate, consistent, and risk-aware decision-making. This study aims to examine the level of academic competence among ATCs and analyze its influence on the improvement of air traffic safety at Perum LPPNPI JATSC Branch. A quantitative research method with an associative approach was employed. The research sample consisted of 98 ATCs selected using a random sampling technique. Data were collected through structured questionnaires and analyzed using validity and reliability tests, descriptive statistics, simple linear regression, and coefficient of determination with the assistance of SPSS software. The results indicate that both academic competence and air traffic service safety fall within the high category, with average scores of 47.52 and 37.66, respectively. Regression and determination analyses demonstrate that academic competence contributes significantly to the improvement of air traffic safety at JATSC. This study concludes that higher levels of academic competence among ATCs positively influence aviation safety performance, emphasizing the importance of continuous academic development and educational enhancement to support safe and effective air traffic services.

Keywords: Academic Competence, Air Traffic Controller, Aviation Safety, Air Traffic Services, Jatsc

INTRODUCTION

Safety in the aviation industry is a non-negotiable aspect, as every operational process must be carried out with precision and consistency to minimize risk. Aviation is classified as a high-risk industry; therefore, systematic risk management through the implementation of a Safety Management System (SMS) is mandatory. This requirement is emphasized in ICAO Annex 19 on Safety Management, which states that aviation safety can only be achieved through a systematic and risk-based safety management approach. Along with these regulatory demands, global air traffic continues to grow significantly. In 2024, ACI World reported that global passenger traffic reached approximately 9.4 billion passengers per year, representing an increase of 8.3% compared to the previous year. This growth indicates that the workload in air navigation services, particularly for Air Traffic Controllers (ATC), is also increasing.

In Indonesia, air navigation services are provided by AirNav Indonesia (Perum LPPNPI). According to the 2022 annual report, AirNav Indonesia managed an average of 4,935 aircraft movements per day, including take-offs, landings, and international and domestic overflights. This operational scale illustrates the significant responsibility borne by ATC personnel in maintaining safe and orderly air traffic operations. One of the most critical operational units within Indonesia's air navigation service network is the Jakarta Air Traffic Service Center (JATSC), which manages highly dense and complex airspace, particularly around major airports and international air routes.

The complexity of operations at JATSC requires ATCs to possess not only technical skills but also strong academic competence, including theoretical understanding, analytical ability, regulatory knowledge, navigation principles, meteorology, standard phraseology, and risk assessment. ICAO Document 10056 on the Air Traffic Controller Competency Framework

emphasizes that formal education and mastery of theoretical knowledge are integral components of ATC professional competence. However, in practice, ATCs at JATSC have diverse educational backgrounds, ranging from vocational education (Diploma II, III, and IV) to undergraduate and postgraduate degrees. These variations may result in differences in analytical and conceptual abilities, particularly as operational demands continue to increase.

Safety data from JATSC further highlight this issue. During the January-June 2025 period, fluctuations in safety incidents were recorded, with increases observed in April and May. Several incidents were associated with human factors, such as inconsistent instructions, phraseology errors, improper conditional clearances, and reduced situational awareness. These conditions indicate that academic competence, which strongly influences analytical thinking and procedural understanding, plays an important role in maintaining air traffic safety. Previous studies have discussed ATC competence and human error; however, empirical research specifically examining the influence of formal academic competence on air traffic safety, particularly in high-intensity units such as JATSC, remains limited. This gap underscores the urgency of conducting an empirical study on this topic.

Based on the background described above, the research questions of this study are as follows:

1. What is the level of academic competence among Air Traffic Controllers at Perum LPPNPI JATSC Branch?
2. Does academic competence have a significant influence on air traffic service safety at Perum LPPNPI JATSC Branch?

RESEARCH METHODS

This study adopted a quantitative research method with an associative approach. Quantitative research was chosen because it enables the examination of relationships and influences between variables using numerical data and statistical techniques. According to Sugiyono (2022), quantitative research is appropriate for hypothesis testing when the data are measurable and can be statistically analyzed. The associative approach was applied to determine whether academic competence has a significant influence on air traffic service safety at Perum LPPNPI Jakarta Air Traffic Service Center (JATSC).

Research Location and Subjects

The research was conducted at Perum LPPNPI Jakarta Air Traffic Service Center (JATSC), located within the operational area of Soekarno-Hatta International Airport. JATSC is one of the busiest and most complex air traffic service units in Indonesia, responsible for managing dense and high-risk airspace. The research subjects consisted of Air Traffic Controllers (ATC) actively involved in operational air traffic services at JATSC.

Population and Sampling Technique

The population of this study included all ATC personnel assigned at Perum LPPNPI JATSC. Considering the relatively large population size, a sampling technique was applied. This study employed probability sampling, specifically simple random sampling, which provides equal opportunity for each member of the population to be selected as a respondent (Sugiyono, 2022). Using this technique, a total of 98 ATC personnel were selected as research respondents, ensuring representativeness and minimizing sampling bias.

Research Variables and Operational Definitions

This study involved two main variables. The independent variable (X) was academic competence, defined as the theoretical and conceptual knowledge possessed by ATCs, including understanding of aviation regulations, navigation principles, standard phraseology, risk assessment, communication skills, and professional ethics (Azwar, 2021; ICAO Doc 10056). The

dependent variable (Y) was air traffic service safety, defined as the level of operational safety achieved through compliance with procedures, effective communication, risk control, and incident prevention, in accordance with ICAO Annex 19 and ICAO Doc 9859.

Data Collection Techniques and Instruments

Data were collected using multiple techniques to enhance validity and reliability. Observation was conducted to obtain direct insight into operational conditions and ATC performance. Library research was used to review relevant literature, ICAO documents, regulations, and safety manuals to support theoretical foundations. The primary data collection instrument was a structured questionnaire distributed to respondents. The questionnaire employed a Likert scale ranging from "strongly disagree" to "strongly agree" to measure respondents' perceptions of academic competence and air traffic service safety (Sugiyono, 2022). The questionnaire items were developed based on established indicators from ICAO standards and previous studies.

Data Analysis Techniques and Statistical Model

Data analysis was conducted using SPSS software. Prior to hypothesis testing, validity and reliability tests were performed to ensure that the research instruments were accurate and consistent. Descriptive statistical analysis was used to describe respondent characteristics and variable tendencies. Normality testing was conducted to confirm data distribution suitability. To examine the relationship and influence between variables, correlation analysis and simple linear regression analysis were applied. Additionally, the coefficient of determination was used to assess the contribution of academic competence to air traffic service safety. These statistical methods are well-established and widely applied in quantitative research, and therefore only their names are presented without extensive formula exposition (Sugiyono, 2022).

RESULTS AND DISCUSSION

This study examines the influence of academic competence on air traffic service safety at Perum LPPNPI Jakarta Air Traffic Service Center (JATSC). Data were obtained from 98 Air Traffic Controllers (ATC) through structured questionnaires, complemented by operational documentation and safety reports. The integrated presentation of results and discussion is intended to provide a comprehensive understanding of empirical findings within the operational context of high-density airspace management.

Respondent Characteristics

The demographic profile of respondents indicates that ATCs at JATSC represent a diverse workforce in terms of gender, age, and educational background. Gender distribution shows a higher proportion of male ATCs, reflecting the general workforce composition in air traffic services. Educational background varies from diploma to postgraduate levels, which provides a relevant basis for analyzing academic competence as a contributing factor to operational safety.

Table 1. Respondent Gender Distribution

Gender	Number of Respondents
Male	60
Female	38
Total	98

The diversity of educational backgrounds among respondents highlights the importance of examining academic competence, as theoretical understanding and analytical skills may differ across educational levels. This condition is particularly significant in JATSC, where operational complexity and traffic density demand high cognitive performance from ATCs.

Academic Competence of Air Traffic Controllers

Academic competence was measured using indicators related to theoretical knowledge, understanding of international regulations, analytical ability, communication skills, and professional ethics. The descriptive analysis shows that academic competence among ATCs falls within the high category, as summarized in Table 2.

Table 2. Academic Competence Score Summary

Variable	Mean Score	Category
Academic competence	47.52	High

The high level of academic competence indicates that most ATCs possess strong theoretical foundations and conceptual understanding necessary to support operational decision-making. This finding aligns with ICAO Doc 10056, which emphasizes that academic competence forms an integral part of the Air Traffic Controller Competency Framework. ATCs with solid academic backgrounds are better equipped to analyze traffic situations, apply standard phraseology correctly, and interpret operational regulations consistently.

From an operational perspective, academic competence supports the ability to anticipate potential conflicts, assess risk, and apply appropriate mitigation strategies. These capabilities are particularly critical in JATSC, where traffic complexity increases the cognitive demands placed on controllers.

Air Traffic Service Safety Performance

Air traffic service safety was assessed through indicators related to compliance with standard operating procedures, effectiveness of ATC–pilot communication, operational risk control, and safety incident reporting. The descriptive analysis shows that air traffic service safety also falls within the high category, as presented in Table 3.

Table 3. Air Traffic Service Safety Score Summary

Variable	Mean Score	Category
Air traffic service safety	37.66	High

This result indicates that safety practices at JATSC are generally well implemented. ATCs consistently apply operational procedures, maintain effective coordination, and actively participate in safety reporting and evaluation processes. These practices are consistent with the Safety Management System (SMS) framework mandated by ICAO Annex 19 and ICAO Doc 9859, which emphasize proactive hazard identification and continuous safety improvement.

Safety Trend Context

To contextualize the safety performance, safety incident trends recorded at JATSC during January-June 2025 were reviewed. The data show fluctuations in incident occurrence, with increases observed in April and May.

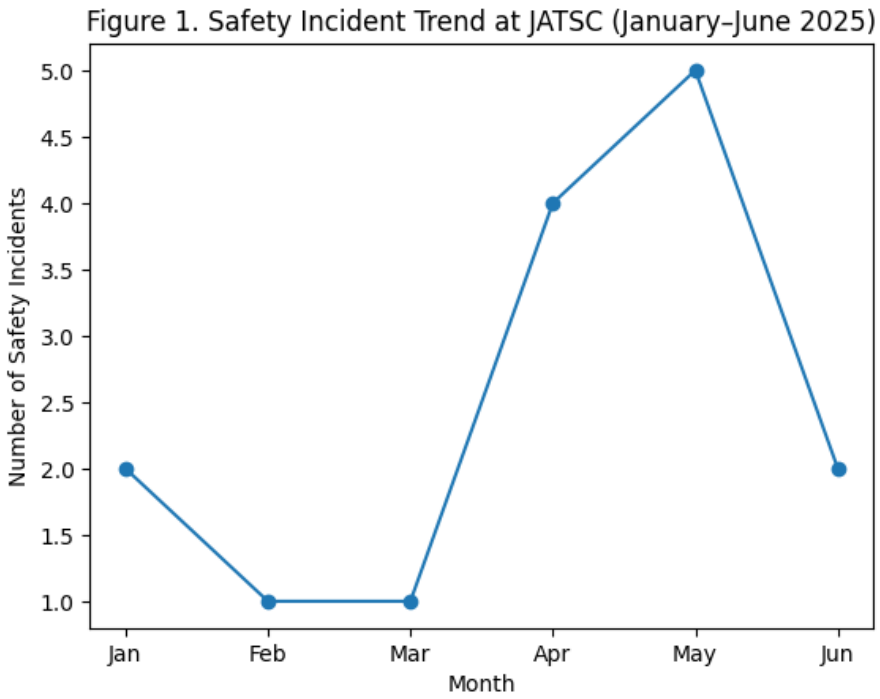

Figure 1. Safety Incident Trend at JATSC (January-June 2025)

Figure 1 illustrates fluctuations in safety incidents at JATSC, with higher occurrences recorded in April and May. This trend highlights periods of increased operational risk, emphasizing the importance of ATC competence in managing traffic complexity and maintaining safety margins.

These trends indicate that while overall safety performance remains high, certain periods present elevated operational challenges. In such conditions, academic competence becomes increasingly important, as ATCs must rely on analytical skills, procedural knowledge, and situational awareness to manage risk effectively.

Relationship Between Academic Competence and Air Traffic Service Safety

The relationship analysis indicates that academic competence contributes positively to air traffic service safety. As summarized in Table 4, correlation and regression analyses show that higher academic competence is associated with improved safety performance.

Table 4. Relationship Between Academic Competence and Safety

Analysis Type	Result Interpretation
Correlation analysis	Positive association
Simple linear regression	Positive contribution

This relationship suggests that academic competence enhances ATCs' ability to interpret operational situations, apply procedures accurately, and communicate effectively. ATCs with stronger academic foundations are better prepared to handle complex scenarios, such as conditional clearances, traffic sequencing, and conflict resolution, particularly during peak traffic conditions.

These findings are consistent with previous studies indicating that competence and education play an important role in improving ATC performance and operational safety (Melissa et al., 2017; Hutabarat et al., 2025). In the context of JATSC, where traffic density and complexity are among the highest in Indonesia, academic competence serves as a critical factor supporting safe and efficient air traffic services.

Overall, the integrated results and discussion demonstrate that while air traffic service safety at JATSC is already at a high level, academic competence significantly supports and reinforces this performance. Continuous development of academic competence through formal education and structured learning programs is therefore essential to sustain safety and adapt to increasing operational demands.

CONCLUSION

Based on the results and discussion, this study concludes that academic competence has a meaningful and positive contribution to air traffic service safety at Perum LPPNPI Jakarta Air Traffic Service Center (JATSC). The findings indicate that both academic competence and air traffic service safety are categorized at a high level, reflecting strong theoretical knowledge, regulatory understanding, analytical ability, and professional behavior among Air Traffic Controllers (ATC). Academic competence supports ATCs in applying standard operating procedures consistently, maintaining effective communication with pilots, managing operational risks, and sustaining situational awareness in a complex and high-density airspace environment. The observed relationship demonstrates that stronger academic foundations enhance decision-making quality and operational discipline, which are essential elements in preventing safety incidents and supporting the implementation of the Safety Management System (SMS). Therefore, continuous development of academic competence through formal education, recurrent training, and structured learning programs is essential to sustain and further enhance air traffic service safety, particularly in operational units with high complexity such as JATSC.

REFERENCES

Azwar, S. (2021). Reliabilitas dan validitas (Edisi ke-5). Yogyakarta: Pustaka Pelajar

Hutabarat, L. T., Pasa, I. T., Saragih, N. A., Pramono, A., & Sony, M. (2025). Human factors and safety performance in air traffic services. Journal of Aviation Safety Studies, 10(1), 45–58

International Civil Aviation Organization. (2018). Safety management manual (SMM) (4th ed.). ICAO.

International Civil Aviation Organization. (2020). Annex 11: Air traffic services. ICAO

LPPNPI. (2022). Laporan kinerja Perum LPPNPI. Jakarta: Perum LPPNPI.

Melissa, A., et al. (2021). Pengaruh kompetensi terhadap kinerja pegawai. Jurnal Administrasi Publik, 6(2), 120–130

Sugiyono. (2022). Metode penelitian kuantitatif, kualitatif, dan R&D. Bandung: Alfabeta